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ABSTRACT

The United States will convert to the metric system of measurement in the near future, and the distributive education programs in high school and at the adult level will have to train the needed personnel for business. The manual gives the basic conversion methods and instruction in teaching metrics. Metric programs conducted for business personnel would be the same as other distributive education programs, with the addition of promotion and publicity releases. The manual includes topical outlines and suggestions for the instructor in five sessions on program management, metric length, metric area, metric volume and capacity, and metric mass (weight). Transparencies testing materials, and student handouts accompany each section. Also included are supplementary materials, film summaries, promotional material, course evaluation sheets, and a list of material sources. (MF)

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A LOOK AT METRICS IN DISTRIBUTIVE EDUCATION

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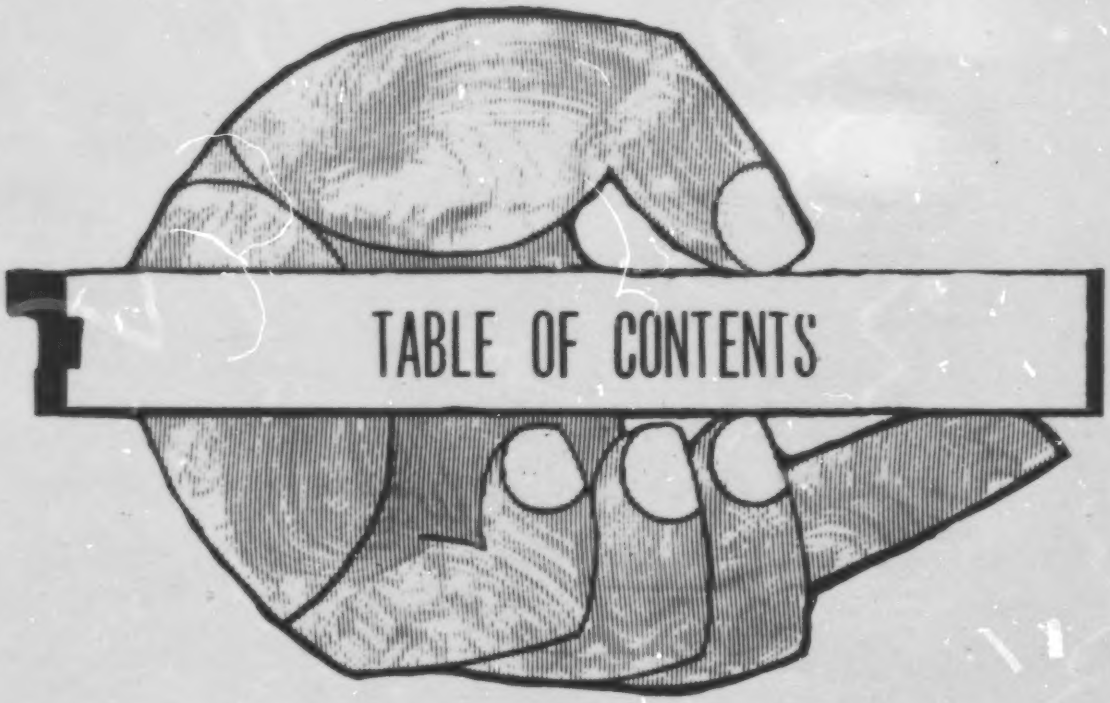

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INTRODUCTION

The United States, in the very near future, will make a firm commitment when the conversion time table for the metric system will be the standard unit of measurement. The Distributive Education programs both in high school and adult level will have to make a strong commitment to the businesses in their locality to give them the needed personnel who have had the basic training in this new system of measurement. On the adult level, it will be the responsibility of the treacher-coordinators who work in adult education to give this additional service to the business, retailing, and wholesaling service establishments in supplementary upgrading training for personnel who are already working.

The primary purpose of this manual is two-fold: to give the instructor the basic conversion methods and to give basic instruction in teaching metrics in distributive education programs. After basic understanding of the metric system has been attained, additional programs could be developed to serve specific marketing occupations.

More information can be found concerning metrics by referring to the section titled bibliography in this manual. A letter can be sent to obtain needed information.

It is not necessary for the average person to be able to convert inches to meters, etc., for this will be done by manufacturers. But, it is essential that everyone learn the basics of the metric system itself. The metric system is much easier to work than our current system once a person has made a whole-hearted effort in trying to understand and work problems.

I would like to thank my secretary, Valerie Lemon, for her diligence, patience, and understanding in typing this manual, and also Cathy Ashmore for her assistance in the final preparation of this manuscript.

Try it and work with the metrics, you'll like it! A transformation like this occurs in business once every 1000 years.

Robert A. Canei

TIPS ON PROGRAM MANAGEMENT

Metric programs that are conducted for business personnel in your particular community should be on the same basis as the rest of the distributive education programs, with the only difference being the promotion of the program. This should be handled separately with more detail in your news releases and other publicity to give the public a complete understanding of what, where, and how this program will benefit them and why it is necessary for them to start training now.

This program can be conducted in 6 or 10 hours, depending on the number of working problems the instructor wants to give the participants in the group. I have not designated a particular time on every section of the manual because of the different needs of a particular group of people or businesses.

In this manual, there are supplementary sections. They are:

1. Supplementary Material - All handouts should be prepared in advance before class. Reproduction should be the best quality in order to make the handout more attractive.
2. Present Problems to Some Marketing and Distribution Areas - This section will give the instructor additional information to prepare them to train people in specific marketing occupations. It can also be used as a guide in preparing questions for the participants in the program.
3. Material for Businesses to Use in Metric Transition Period - This section will give business and distributive education personnel a few guidelines in changing former customary measurement system to the metric system and plans to implement to metric.
4. Films - They can be used to teach the metric system to business personnel and individuals who want to upgrade themselves in the metric area.
5. Promotional Material - This section will give a teacher-coordinator a basic idea of what type of promotional material they can develop to use in their community.
6. Course Evaluations - There are sample copies of different evaluations that can be used to meet the needs of a particular program.

7. Bibliography and Reference on Metric - In this section, a list of companies has been compiled who have material in teaching aides in the metric system.

Other suggestions for a successful metric program are:

Number of Participants - The maximum number of participants per class should be 25. The minimum will have to be in accordance to the rules and regulations of the institution.

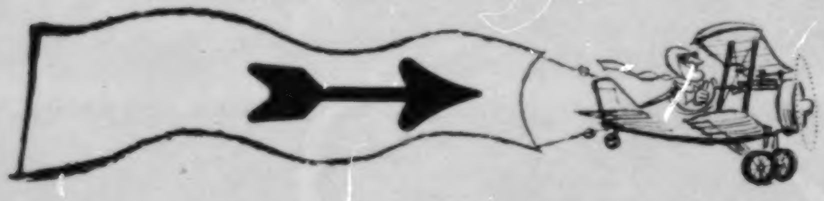
Participants - They can be people who are already working or people who are thinking about working in one of the marketing and distributive occupations.

Instructor - Recruitment of the instructor who will teach this program should include looking for someone who has a thorough understanding of the metric system and also should have experience in marketing and distribution. Consider a person who has good, basic background in math.

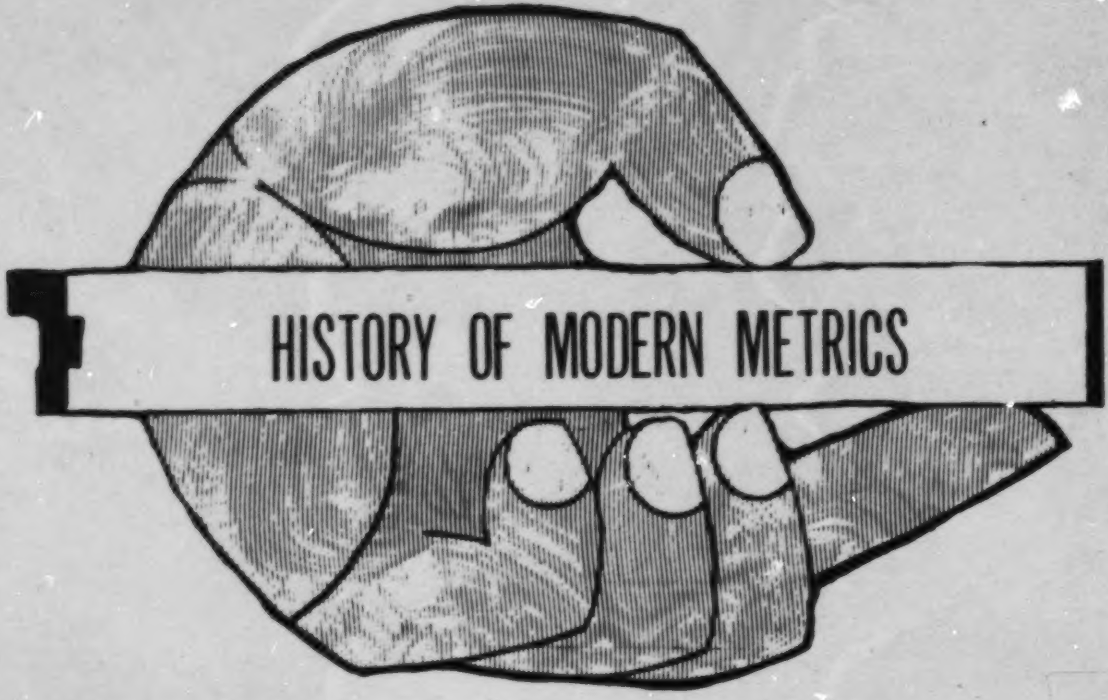
Suggested Methods of Teaching - A variety of methods should be used to make the metric program interesting and stimulating to the participants.

Class Arrangement - The room should be in a U-shape design to give the participants a feeling of being comfortable and be able to see the flip chart and chalkboard when the instructor uses it. Also, the instructor should check ahead of each session to see what appropriate equipment he would need to assist him in his instruction.

Transparencies - If transparencies are used, they should be reproduced clearly enough that there is no blurr in reading the copy from the farthest point in the room.



SESSION I:


HISTORY OF MODERN METRICS

Topical Outline	Suggestions for Instructors
I. INTRODUCTION	Arrive early for the first session. Check room for seating arrangements, ash trays, name tags, etc. Place any visuals you plan to use in a convenient spot and be sure that your notes and materials for the first session are in order. Greet each person as they enter, make them feel at ease. (Do this for all sessions.) Pass out pre-test and give participants time to try to answer questions. (Handout I-1)
II. HISTORY	
A. 150 years ago, John Quincy Adams wrote a comprehensive report for Congress based on 4 years of study. His report dealt with the metric question and the modernization of the U.S. measurement system. He emphasized that all measurements must be exact in order for our society to operate at all.	Lecture Handout - Report to Congress (I-2)
Take for example a bushel. The way it stands now, a bushel of 3 different items will have 3 different weights, depending on what the item is, and which state it is measured in.	
At one time, the yard was measured by the distance from a person's nose to his thumb....hardly an exact measure.	
B. Why is the U.S. Considering Metrics?	Question: Why is the U.S. considering the Metric System now? Answer: To relate trading policies of the U.S. to all major countries of the world who are on the Metric System. Handout - Why Change to Metrics? (I-3) Ask participants to read and discuss I-3. List the important points on the chalkboard.

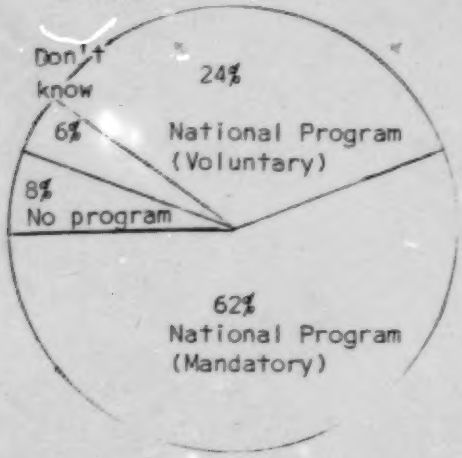
Topical Outline	Suggestions for Instructors
C. World Progress on Metric System Conversion	
Changing to the metric system has never come overnight.	Lecture
In 1790, Tallyrand, a bishop in France started formulating the Metric System. By passage of a law in 1837, the Metric System finally became compulsory throughout France after January 1, 1840. One can see how long it took for France to establish Metric as their system of measurement. By 1850, Netherlands, Greece, Spain, and parts of Italy joined France in Metric measurement.	
Now, only these countries do not use the Metric System:	Pass out Handout I-4.
Australia Barbados Batswana Burma Canada Ceylon Cyprus Gombia Jamaica Lesotho Liberia Malawi Malta New Hebrides New Zealand Sierra Leone Trinidad & Tobago United States Western Samoa Zombia	
Countries that are converting are also included on Handout I-4.	
The World's Metric Countries	Handout - The World's Metric Countries (I-5)
Growth of the Metric System	Handout - Growth of the Metric System (I-6) Spend time to relate each major country's effect on U.S. trading. Show examples.
D. Why Has United States Not Changed	
People are often reluctant to accept new ways of doing things in the past 100 years, conversion to the Metric System has been publicly fought for a variety of reasons which have been proven false and sometimes	Lecture

ridiculous. Some of these reasons include:

1. The French metric system is unscientific. (What could be more exact than multiples of 10?)
2. It is founded on a curved line instead of a straight line. (Ridiculous, this is untrue.)
3. It is inharmonious with nature. (Not true.)
4. Its terms are cumbersome and long. (This may have been true at first, but standardization has taken care of this problem.)
5. Its units of length is not a natural stride, and has not reference to personal measures. (Who cares? Does a personal measure such as the size of your foot really matter?)
6. It is offensive in its religious relations. It is not in consonance with, and is farthest removed from, scriptural and sacred systems of weights and measures, of all known systems. (We can see how religion has effectively fought change in our past.)
7. The adoption of the French system by us would be practically and profoundly oppressive. Foreign system used in America instead of American system used in America. (Does the U.S. always have to be first in developing things? Maybe others have good ideas too!)

E. Attitudes Toward Going Metric

The U.S. Metric Study approached nonmanufacturing businesses with a survey on the Metric System. The results are these:

Topical Outline	Suggestions for Instructors
*Attitude toward increased metric usage in own company without awaiting a national discussion. RESULTS: 13% Strongly for 17% Mildly for 44% Neutral 12% Mildly against 14% Strongly against	Show Transparency I-1. Attitude Toward Using Metrics.
*Is increased metric usage in the "best interests of the United States?" RESULTS: 61% Yes 17% Don't know 22% No	Show Transparency I-2. Should the U.S. Use Metrics?
*If increased metric usage is in the "best interests of the United States," what course of action? RESULTS: 	Show Transparency I-3. How Should the United States teach metrics?
*An interesting fact from this study noted the larger the business, the more positive were the employees in the Metric System being beneficial to them and the country.	

Topical Outline	Suggestions for Instructors
F. The New International System of Units	
The Metric System before 1960 had many changes, but in 1960, the metric system and its units were redefined in an effort to correct some deficiencies that had developed over the years. When the metric system began, the most pressing need of the time was to standardize units of measure to expedite the fair exchange of goods and services. Primary attention was therefore given to standardizing the relatively more simple concepts of length, area, volume, and weight.	Lecture
It was not until many years later that the rapid growth of world-wide science and industry led to the requirement for units for the measurement of other physical quantities. When these new units of measure were established, they were often defined in terms of metric system units due to the relative exactness of the definition of the basic metric units for weight, length, and volume. However, these new units were sometimes established by different scientific methods which often resulted in more than one metric unit for measuring the same physical quantity.	
By the year 1900, measurements in the metric system began to be based on meter-kilogram-second units (MKS). Later, Professor Giorgi of Italy recommended that the units of mechanics should be linked with electro-magnetic units, and the ampere was added to create the MKSA (Giorgi) units.	
The multiplicity of metric units was reduced by the Tenth General Conference of Weights and Measures, of the International Organization of Weights and Measures.	

Topical Outline	Suggestions for Instructors
This Tenth General Conference, held in 1954, adopted a rationalized and coherent system of units based on the 4 MKSA units plus the kelvin as the unit of temperature and the candela as the unit of luminous intensity. The Eleventh General Conference of Weights and Measures in 1960, formally gave the new system its full title "Systeme International d'Unites," for which the universal abbrevation is "Metric-SI."	
III. UNITS OF METRIC MEASURE	
A. What is a meter?	Ask group participants to give an example of a meter.
A meter is the basic unit to measure length. It's a little longer than a yard. (39 3/8 inches long).	
Think of the distance from your nose to your outstretched thumb and add 3 3/8 inches...that's a meter!	Have a yardstick or a bolt of cloth available to demonstrate.
B. What is a gram?	Ask group participants to give an example of a gram.
A gram is the basic unit to measure weight. It is very tiny and light in weight.	
Think of a paperclip, a price-ticket, or a pinch of salt.	
C. What is a liter?	
A liter is the basic unit for measuring the amount of liquid in a container.	
Think of a quart of milk, and add 5%...that's a liter!	Set an empty quart container in front of a liter poster to make the visual comparison.
D. What is a second?	
We all know that. It's the basic measure of time in a metric system as well. There's no change here.	

Topical Outline	Suggestions for Instructors

E. What is a kelvin?

A kelvin is the basic unit of measure of temperature in the Metric-SI System.

Since Celsius developed this measure, we can compare the Celsius scale with our current Fahrenheit scale as follows:

Instead of freezing at °32F, we will now freeze at °0 Celsius.

A comfortable room will be 20 Celsius and you'll be very warm if the outside temperature goes over °35 Celsius.

F. There are 8 basic units of measure in the current metric system. However, those not mentioned in this course are primarily applicable to engineering and manufacturing processes and will not be taught here. Those omitted include amperes, moles, and candelas.

IV. HOW TO SEPARATE METRIC UNITS

A. Every school child spends considerable time learning that there are 12 inches in a foot, 16 ounces in a pound, and so on. The metric system simplifies this whole process by using only the units of 10.

Think of a dollar bill as a standard unit:

kilo	1000 x dollar	$1000.00
hecto	100 x dollar	100.00
deca	10 x dollar	10.00
unit	dollar	1.00
deci	1/10x dollar	.10
centi	1/100x dollar	.01
milli	1/1000x dollar	.001

Show Transparency I-4. This transparency is a two-part hinged visual. Show part A first and then overlay Part B, matching the register marks. (⌖)

In this example, each part of a dollar bill can be broken down in dimes or pennies by

Topical Outline	Suggestions for Instructors
moving the decimal point 1 place to the left and in multiples of a dollar by moving the decimal point 1 place to the right.	
In math, this is known as a base 10 system. It merely means multiplying by 10 to get larger numbers and dividing by 10 to get smaller numbers.	
In each case, the decimal point moves one place to the left as the 10's progress down and 1 place to the right as they progress upwards.	
	Pass out Handout I-7. and ask participants to quickly fill in the correct answers.
	Then show Transparency I-5. Ask respondents to correct their own mistakes. Suggest some practice to those who cannot do this type problem.
How many of you had to really think about these answers? Or did you count the 0's in the second number and move your decimal point to the left where you were dividing, or to the right when you were multiplying?	Ask.
	Show answer sheet on the overhead, explaining just how this always works.
Remember, any whole number has a decimal point which belongs to its right, for example: 1 = 1.0 10 = 10.0	
B. Every unit in the metric system uses the same symbols to break the unit into parts. For example: centi means 1/100 of the unit. We have: centi-meter- length centi-liter- volume centi-gram- weight	
Before you can work with the metric system, you must become thoroughly acquainted with the pre-fixes and what they mean.	

Topical Outline	Suggestions for Instructors
Tieing the prefixes to the unit involved in discussing length then comes out as follows: 10^{-3} meter = a millimeter (mm) .001 10^{-2} meter = a centimeter (cm) .01 10^{-1} meter = a decimeter (dm) .1 10 meter = a meter (m) 1 10^{1} meter = a dekameter (da) 10 10^{2} meter = a hectometer (ha) 100 10^{3} meter = a kilometer (km) 1000	Show Transparency I-6. Then pass out Handout I-8, and ask them to study it for the next session.
C. Some Important Rules to Remember As in any system, there are rules to follow and metrics is not exception. Try to remember the following: 1. identify all terms with small letters (i.e. "m" for meter, "g" for gram, "l" for liter). Never use capitals as the meanings may change. 2. don't use commas or periods. (i.e. 1 000m) - use a space. This is the rule in any case where one has 4 figures or more. 3. always use the identifying symbols with each figure. (i.e. 10m)	
V. REVIEW OF THE SESSION	Review major points and remind participants to study Handout I-8 for the next session.

Handout I-1

PRE-TEST

1. How long is your car?
2. What do you weigh?
3. What is the temperature outside today?
4. What size shoe do you wear?
5. What is your favorite female's measurements?
6. What is your head size?
7. How much liquid do you drink a day?
8. How far is it to New York City?
9. What area does your bed cover?
10. What is the approximate cubic area of this room?

NOTE: Participants should find out the answers they missed throughout the metric training program.

THINK METRIC!

Handout I-2

REPORT TO CONGRESS, 1821

Weights and Measures may be ranked among the necessaries of life to every individual of human society. They enter into the economical arrangements and daily concerns of every family. They are necessary to every occupation of human industry; to the distribution and security of every species of property; to every transaction of trade and commerce; to the labors of the husbandman; to the ingenuity of the artificier; to the studies of the philosopher; to the researcher of the antiquarian; to the navigation of mariner and the marches of the soldier; to all the exchanges of peace and all the operations of war. The knowledge of them, as in established use, is among the first elements of education, and is often learned by those who learn nothing else, not even to read and write. This knowledge is riveted in the memory by the habitual application of it to the employments of men throughout life.

John Quincy Adams

Handout I-3

WHY CHANGE TO METRICS?

The American economy today depends as never before on trading new materials, manufactured products, and technological ideas with countries abroad, all of whom use or are changing to metric. Though small in relation to the total economy, our exports are crucial to maintaining a favorable trade balance in an increasingly metric world. The United States puts itself at a disadvantage competitively by using a measurement system that is different from that of the world market.

U.S. companies that want to make metric products, usually for sale abroad, have found it advantageous to build where they employ native workers who know the metric system. Such export of jobs is a problem that a national changeover to the metric system would help to halt.

America's military allies are either already using the metric system or committed to becoming metric. Therefore, military coordination and logistics would be simplified by conversion to metric. Use of metrics would make all U.S. and foreign military equipment more compatible.

Moreover, if the United States is part of a common system, there should be one less hangup in relations with other nations.

And the fewer obtacles the better when it comes to setting international standards of all sorts, especially those concerned with industrial products. Going metric should help this country win acceptance for its ideas.

That last point was particularly emphasized in the recommendations resulting from the national metric study. "Standards" refer not only to units of weight and measurement, but also to product performance, quality control, applications, and so on. Engineering standards serve a technical society as both a dictionary and a recipe book. They specify characteristics of things or ways to do things - almost everything that can be measured or described.

Standards cover an enormous range. For example, the diameter of wire, the purity of aspirin, the meat content of frankfurters, the symbols on highway signs, the fire resistance of clothing, the wattage of light bulbs, the weight of a nickel, and the way to test for sulphur in fuel oil, to name but a few.

The Department of Defense and the General Services Administration have issued for Government use about 40,000 procurement standards. Hundreds of private, voluntary groups have issued about 20,000 (one-fifth of which are recognized as national standards).

Where U.S. standards differ from international standards, trade can be hindered. To date, relatively few international standards, 1,500 or so, have been adopted, but the number is expected to increase tenfold within the next 10 years. It is in the best interests of the United States to get in on the ground floor in the setting up of new international standards because such standards form the basis for international trade. Already, multinational corporations are tending to integrate the world economy and are helping to bring about worldwide uniformity of engineering standards. In a metric world, it is evident that these uniform international engineering standards will predominantly use metric weights and measures.

To sum up the advantages, a metric America would seem desirable in terms of the Nation's stake in world trade, its national security, its relations with its neighbors, and its participation in the development of international standards.

COUNTRIES NOT ON METRIC SYSTEM

The following countries do not use the metric system officially. In those bracketed, it is used together with a local or the inch-pound system.

Australia
Barbados
Botswana
Burma
Canada
Ceylon
(Cyprus)
Gambia
Jamaica
Lesotho
Liberia
Malawi
(Malaysia)
Malta
(New Hebrides)
New Zealand
Sierra Leone
Trinidad and Tobago
United States
Western Samoa
Zambia

COUNTRIES THAT ARE CONVERTING TO METRIC

The following countries are in the process of converting to the metric system:

Eire
Ghana
Kenya
Kuwait
Pakistan
South Africa
Tanzania
Uganda
United Kingdom

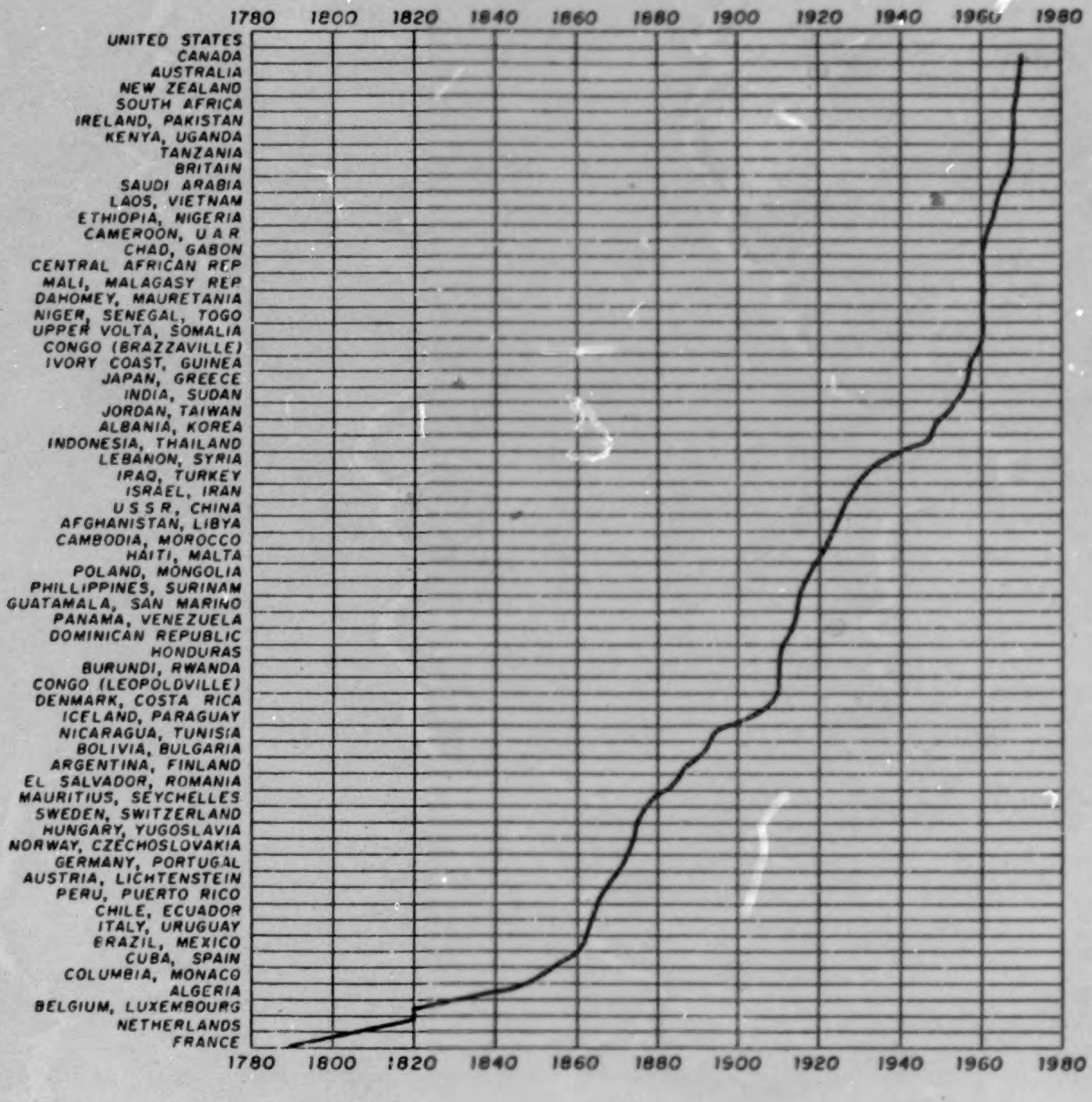
Handout I-5

THE WORLD'S METRIC COUNTRIES

Afghanistan
Albania
Algeria
Andorra
Angola
Argentina
Austria
Belgium
Bolivia
Brazil
Bulgaria
Burundi
Cambodia
Cameroom
Canary Islands
Cape Verde Islands
Central African Republic
Chad
Chile
China, People's Republic
German Federal Republic
Greece
Greenland
Guadeloupe
Guatemala
Guinea
Haiti
Honduras
Hungary
Iceland
India
Indonesia
Iran
Iraq
Israel
Italy
Ivory Coast
Japan
Korea, Republic
Laos
Lebanon
Libya
Liechtenstein
Luxemburg
Macao
Malagasy Republic
Mali
Martinique
Mauritania
Mauritius
Mexico
Monaco
Mongolia
Morocco
Mozambique
Nepal
Columbia
Congo
Congolese Republic
Costa Rica
Cuba
Czechoslovakia
Dahomey
Denmark
Dominican Republic
Ecuador
El Salvador
Equatorial Guinea
Ethiopia
Faroe Islands
Finland
France
French Guiana
French Somaliland
Gabon
German Democratic Republic
Netherlands
Netherlands Antilles
New Caledonia
Nicaragua
Niger
Norway
Panama
Paraguay
Peru
Philippines
Poland
Portugal
Portuguese Guinea
Reunion
Rumania
Rwanda
San Marino
Sao Tome and Principe
Saudi Arabia
Senegal
Seychelles
Singapore
Somalia
Spain
Sudan
Surinam
Sweden
Switzerland
Syria
Taiwan
Thailand
Togo
Tunisia
Turkey
United Arab Republic
Upper Volta
Uruguay
U.S.S.R.
Venezuela
Vietnam, Republic
Yugoslavia

Handout I-6

ADVANCE OF METRIC USAGE IN THE WORLD



CAN YOU DO BASE 10 IN MONEY?

$10.00 ÷ 10 = ____________

$100.00 ÷ 100 = ____________

$10.00 ÷ 1000 = ____________

$10.00 ÷ 100 = ____________

$1.00 ÷ 10 = ____________

$100.00 ÷ 10 = ____________

$10.00 × 10 = ____________

$.01 × 1000 = ____________

$.10 × 10000 = ____________

$1000.00 × 10 = ____________

Handout I-8

METRIC STUDY SHEET

Metric Units

Meter is: ____________________

____

Liter is: ____________________

____

Gram is: ____________________

____

PREFIXES FOR METRIC SYSTEM

PREFIX	PART OF UNIT	SYMBOL
kilo	1000 x 1	k
hecto	100 x 1	h
deca	10 x 1	da
unit	1	
deci	1 x .1	d
centi	1 x .01	c
milli	1 x .001	m

Transparency I-1

ATTITUDE TOWARD USING METRICS

13%	STRONGLY FOR
17 %	MILDLY FOR
44%	NEUTRAL
12 %	MILDLY AGAINST
14 %	STRONGLY AGAINST

SHOULD THE U.S. USE METRICS?

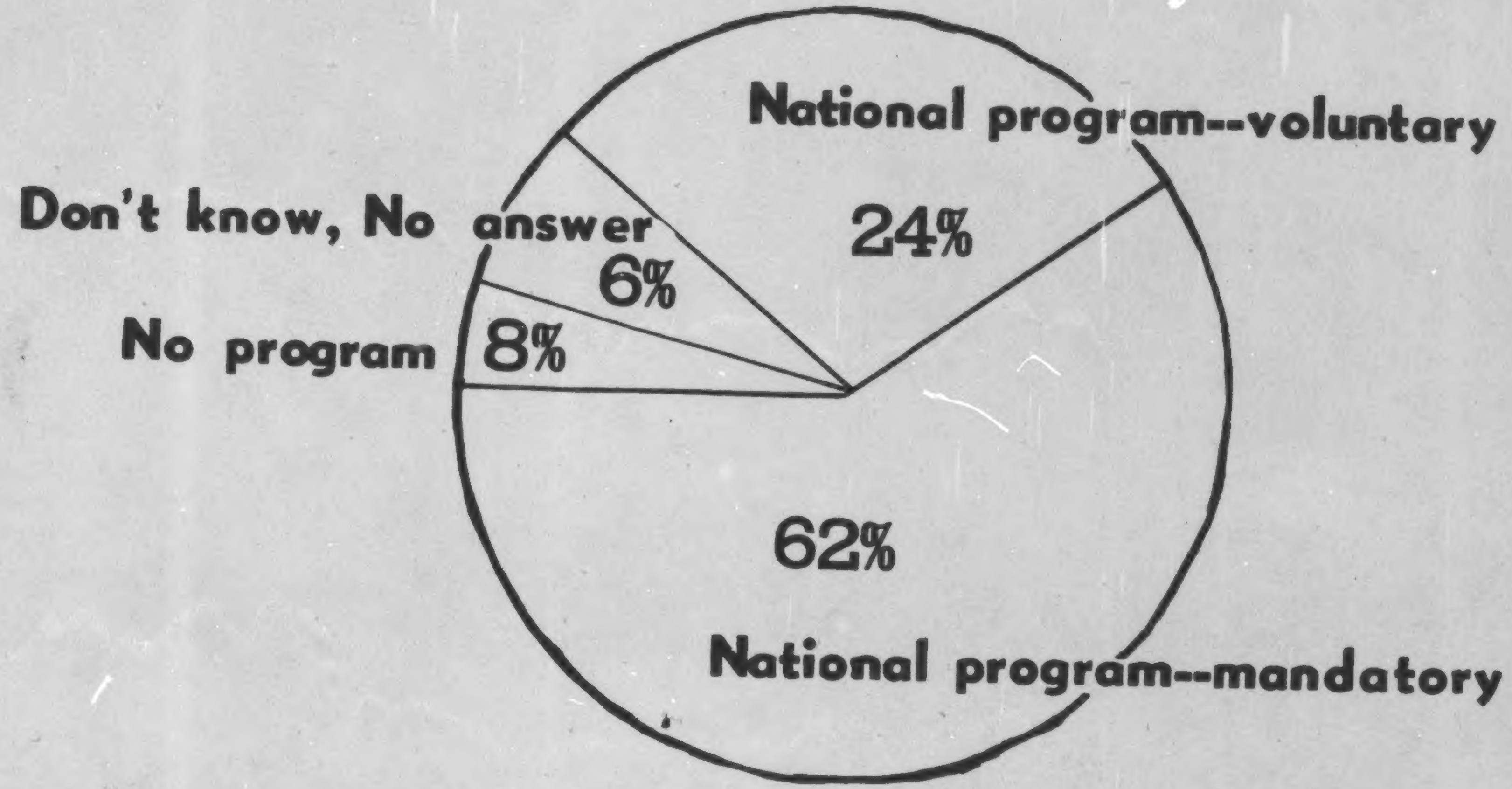
YES 61 %

DON'T KNOW 17 %

NO 22 %

Transparency I-3

HOW SHOULD THE U.S. TEACH METRICS?



Transparency I-4, Part A.
This transparency is a two-part hinged visual. Show Part A first and then overlay Part B, matching the register marks. ( )

1000 × dollar = $1000

100 × dollar = $ 100

10 × dollar = $ 10

dollar $ 1.00

1/10 × dollar = $ .10

1/100 × dollar = $ .01

1/1000 × dollar = $ .001

METRICS IS LIKE DOLLARS

Transparency I-4, Part B.

KILO

HECTO

DECA

______

DECI

CENTI

MILLI

Tranparency 1-5

CAN YOU DO BASE 10 IN MONEY?

$10.00 ÷ 10 = $1.00

$100.00 ÷ 100 = $1.00

$10.00 ÷ 1000 = $ .01

$10.00 ÷ 100 = $ .10

$1.00 ÷ 10 = $ .10

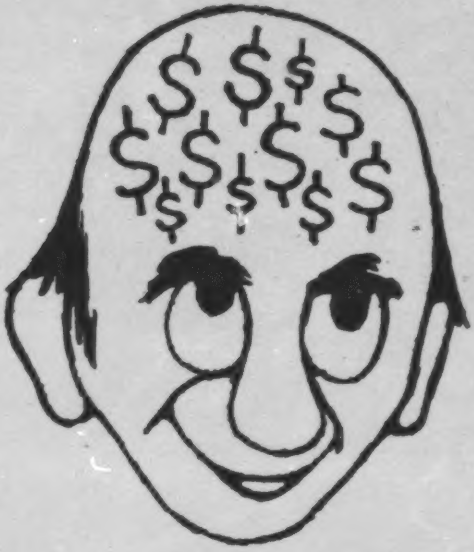
$100.00 ÷ 10 = $10.00

$10.00 × 10 = $100.00

$.01 × 1000 = $10.00

$.10 ×10000 = $1,000.00

$1000.00 × 10 = $10,000.00



Transparency I-6

10^{-3} meter = a millimeter (mm) .001

10^{-2} meter = a centimeter (cm) .01

10^{-1} meter = a decimeter (dm) .1

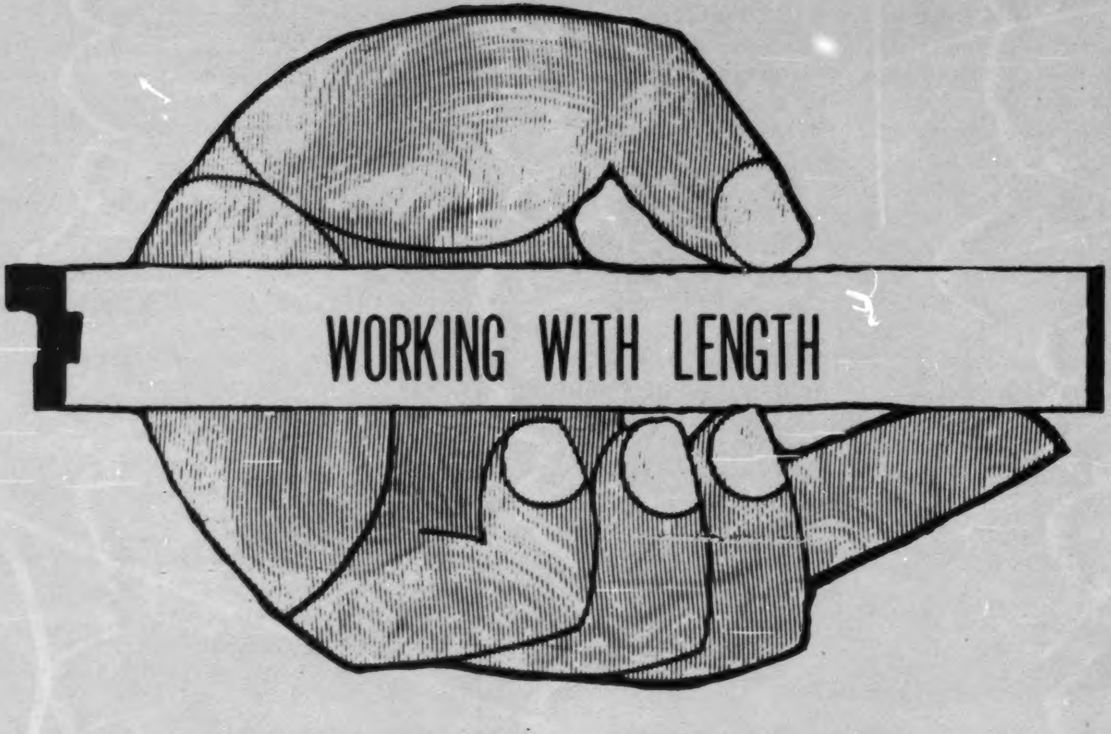
10 meter = a meter (m) 1

10^{1} meter = a dekameter (da) 10

10^{2} meter = a hectometer (ha) 100

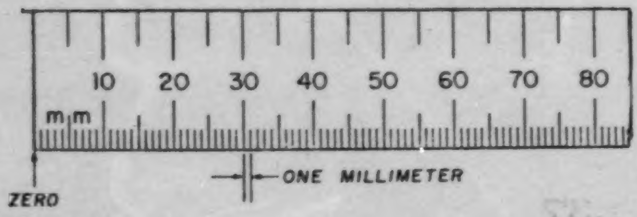
10^{3} meter = a kilometer (km) 1000

SESSION II:

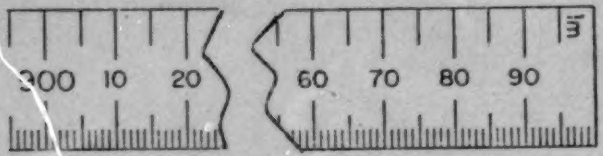

WORKING WITH LENGTH

Topical Outline	Suggestions for Instructors
I. REVIEW	Review major points from first session.
A. Why is the metric system now considered an advantage to the U.S.?	ASK.
Advantages of Metric There are many advantages to Metric-SI which simplify learning processes and also remove many of the pitfalls present in our U.S. customary system of weights and measures: 1. Metric-SI provides for an International Standard of Measurement in all but 21 countries of the world. 2. Metric-SI is a coherent system based on 7 base units. Coherent simply means that all the other units or dervied units have been established from the product or quotient of 2 or more other Metric-Si units. 3. The units which describe the quantities remain the same. No longer is it necessary to memorize the number of ounces in a pound, pounds in a ton, or inches in a foot, feet in a yard, yards in a mile, etc. 4. The names of units regardless of technology, remain the same. 5. Metric-SI is a decimal system based on the powers of 10, as in our present monetary system. Mechanical arithmetic associated with fractions is eliminated, therefore, improvement in accuracy and speed of calculation is an inherent advantage.	
	B. Review worksheet from first session. Ask a member of the group to put prefixes in proper order on hook 'n loop board. In advance of meeting, cut out words and have them mixed up on the table.

Topical Outline	Suggestions for Instructors
C. How many millimeters does it take to equal each of the following, if you have 7654321 millimeters? 7 654 321. millimeters mm =765 432.1 centimeters cm =76 543.21 decimeters dm =7 654.321 meters m =765.4321 decameters dam =76.54321 hectometers hm =7.654321 kilometers km	C. Apply the knowledge of how the prefix system works with meters by working this problem on the chalkboard.
D. On this basis, any measurement of length will utilize for almost all of our daily activities the meter and the millimeter. When we use long distances, we'll use the kilometer. This is just over half the length of our mile, 0.6 to be exact. Therefore, for linear measure you have to get 3 metric terms into focus: the meter, the millimeter, and the kilometer.	
Definition of Metric System	
Meter: Primary unit for measuring length. It is divided into smaller parts (into tenths). Every multiple or submultiple in metrics has both a name and a numerical value which are used together. Each name has its own symbol which is directly related to its spelling. These are called prefixes.	Put on chalkboard
II. THE METRIC RULER	
Most metric rules for everyday use will be divided into small increments using the millimeter (1/1000th of a meter). The ruler or tapes have bold figures at every 10mm mark. An illustration follows:	Have a Metric Ruler made on poster paper, tack it on bulletin board. Instructor should be very clear and thorough in making sure everyone has a clear understanding of meter and meter base. Go over as many times as needed.



Topical Outline	Suggestions for Instructors



You have 1000 millimeters in 1 meter
1000mm = 1 m

III. PROBLEMS

A. Metric Units of Length (Handout II-1)

1. Which is longer, a centimeter or an inch? inch
2. 1 inch is about 2 1/2 centimeters.
3. 1 centimeter is about 2/5 inch.
4. 4 cm = 40 mm
5. 3 cm = 30 mm
6. 2 cm = 20 mm
7. 1 cm = 10 mm
8. Use the centimeter ruler to find the length of this line segment. (Draw a 10cm line)
9. 1 dm = 10 cm
10. 1 dm = 100 mm
11. 1 meter is about 8 or 9 cm longer than 1 yard.
12. 1 meter is about 3 or 3 1/2 inches longer than 1 yard.
13. 1 m = 100 cm
14. 100 cm = 10 dm
15. 1000 mm = 1 m

Underline the fraction that makes each sentence true.

16. 1 decimeter is (1/10, 1/100, 1/1000) of a meter.
17. 1 centimeter is (1/10, 1/100, 1/1000) of a meter.
18. 1 millimeter is (1/10, 1/100, 1/1000) of a meter.

Make a metric ruler for each person by running copies of Handout II-8, and cutting and taping it together.

Give one to each person to do the problems coming up in this session.

Make handouts on problems for each participant in the program.

Instructor can change or delete from the following problems according to the needs of the class.

Have each student complete problems separately. The instructor should walk around and assist anyone in trouble. Then go over correct answers with the group.

Topical Outline	Suggestions for Instructors
19. Ron ran 45 yards. Cathy ran 45 meters. Who ran farther? Cathy How do you know? I meter is longer than a yard. 20. A spider went 9 cm. An ant went 9 inches. Which went farther? ant How do you know? I inch is longer than I centimeter.	Review answers to Handout II-I to be sure participants understand and are able to continue with more problems.

B. More Metric Units of Length (Handout II-2)

1. I dam = 10 m
2. 2 dam = 20 m
3. 7 dam = 70 m
4. 30 m = 3 dam
5. 80 m = 8 dam
6. 100 m = 10 dam
7. I hectometer is about 8 I/2 meters longer than 100 yards
8. 10 m = I dam
9. 100 m = I hm
10. 100 m = 10 dam
11. 2 hm = 200 m
12. 7 hm = 700 m
13. 10 hm = 1000 m
14. 2 km = 2000 m
15. 9 km = 9000 m
16. 13 km = 13000 m
17. 3000 m = 3 km
18. 7000 m = 7 km
19. 23 000 m = 23 km

Complete this table:

Metric Units of Length

EX:	kilometer	km	1000	m
20.	hectometer	hm	100	m
21.	dekameter	dam	10	m
22.	meter	m	I	m
23.	decimeter	dm	1/10	m
24.	centimeter	cm	1/100	m
25.	millimeter	mm	1/1000	m

Review answers to Handout II-2.

Topical Outline

C. Estimating and Measuring (Handout II-3)

Estimate the length of each object in centimeters. Then find the length of each object to the nearest centimeter. Estimates will vary. Illustrations used in this problem should equal the answers.

1. 11 cm
2. 7 cm
3. 3 cm
4. 1 cm
5. 5 cm
6. 3 cm
7. 4 cm
8. 4 cm

Estimate each of the following to the nearest meter. Use a meter stick to find each to the nearest meter. Answers will vary.

9. the height of a door
10. the length of your classroom
11. the width of your classroom

Estimate the length of each object in millimeters. Find the length to the nearest millimeter. Record each measurement in 2 ways as shown in the table. Illustrations in this problem should equal answers.

12. 62 mm = 6 cm 2 mm
13. 30 mm = 3 cm
14. 51 mm = 5 cm 1 mm
15. 45 mm = 4 cm 5 mm
16. 36 mm = 3 cm 6 mm

Use a millimeter ruler to draw line segments of the following lengths.

17. 16 cm
18. 97 mm
19. 5 cm 8 mm
20. 13 cm 4 mm

Suggestions for Instructors

Review answers to Handout II-3.

Topical Outline	Suggestions for Instructors

D. Adding Metric Measures (Handout II-4)

1. A quarter is 24 mm across. A nickel is 19 mm across. The distance across both coins is 43 mm.
2. The problem could have been worked like this: 24 mm = 2 cm 4 mm plus
3. 19 mm = 1 cm 9 mm

Find each sum:

4. 54 mm
+ 27 mm
81 mm

5. 18 mm
+ 36 mm
54 mm

6. 43 mm
+ 37 mm
80 mm

7. 2 cm 8 mm
+(3 cm 3 mm)
6 cm 1 mm

8. 7 cm 5 mm
+(1 cm 7 mm)
9 cm 2 mm

9. 4 cm 9 mm
+(2 cm 8 mm)
7 cm 7 mm

10. 16 cm
+ 47 cm
63 cm or 6 dm 3 cm

11. 38 cm
+ 15 cm
53 cm or 5 dm 3 cm

12. 54 cm
+ 39 cm
93 cm or 9 dm 3 cm

13. 3 m 4 dm 6 cm
+(2 m 5 dm 2 cm)
5 m 9 dm 8 cm

14. 4 m 1 dm 2 cm
+(3 m 4 dm 9 cm)
7 m 6 dm 1 cm

15. 1 m 6 dm 3 cm
+(6 m 4 dm 8 cm)
8 m 1 dm 1 cm

16. 6 dm 3 cm 4 mm
+(2 dm 5 cm 7 mm
8 dm 9 cm 1 mm

17. 4 dm 6 cm 5 mm
+(2 dm 4 cm 8 mm)
7 dm 1 cm 3 mm

Topical Outline | Suggestions for Instructors

18. 4 dam 3 m 8 dm
+(2 dam 6 m 1 dm)
6 dam 9 m 9 dm

19. 6 dam 7 m 6 dm
+(1 dam 1 m 5 dm
7 dam 9 m 1 dm

20. 3 dam 8 m 4 dm
+(5 dam 3 m 9 dm
9 dam 2 m 3 dm

Review the answers to Handout II-4.

E. Subtracting Metric Measures
(Handout II-5)

1. A ribbon 16 cm 2 mm long was cut. The piece cut is 8 cm 4 mm long. How long is the piece left?
7 cm 8 mm
2. 15 cm 8 mm
3. 15 cm 12 mm

Find the difference.

4. 32 cm
- 17 cm
15 cm

5. 44 mm
- 25 mm
19 mm

6. 66 m
- 47 m
19 m

7. 9 cm 3 mm
-(4 cm 2 mm)
5 cm 1 mm

8. 8 cm 4 mm
-(5 cm 7 mm)
2 cm 7 mm

9. 7 cm 3 mm
-(6 cm 5 mm)
8 mm

10. 5 dm 1 cm
-(1 dm 4 cm)
3 dm 7 cm

11. 4 m 8 dm
-(2 m 9 dm)
1 m 9 dm

12. 17 m 6 dm
-(9 m 8 dm)
7 m 8 dm

13. 6 dm 7 cm 3 mm
-(2 dm 4 cm 8 mm)
4 dm 2 cm 5 mm

14. 4 dm 3 cm 9 mm
- (1 dm 6 cm 7 mm)
2 dm 7 cm 2 mm

Topical Outline	Suggestions for Instructors

15. 8 dm 1 cm 2 mm
-(3 dm 5 cm 4 mm)
4 dm 5 cm 8 mm

16. 5 m 8 dm 3 cm
-(2 m 7 dm 6 cm)
3 m 0 dm 7 cm

17. 6 dam 3 m 9 dm
-(2 dam 5 m 7 dm)
3 dam 8 m 2 dm

18. 8 dam 4 m 7 dm
-(6 dam 8 m 9 dm)
1 dam 5 m 8 dm

19. 7 hm 5 dam 6 m
-(4 hm 3 dam 8 m)
3 hm 1 dam 8 m

20. 5 km 8 hm 4 dam
-(2 km 9 hm 2 dam)
2 km 9 hm 2 dam

Review the answers to Handout II-5.

F. Problems about Length (Handout II-6)

Use a millimter ruler to find how far the ant traveled.

1. From A to B 3 cm 5 mm
2. From B to C 5 cm 7 mm
3. From A to B to C 9 cm 2 mm

Do the same to find how far the fly traveled.

4. From D to E 4 cm 6 mm
5. From E to F 2 cm 8 mm
6. From D to E to F 7 cm 4 mm

7. Did the ant or the fly travel farther? Ant How much farther?
1 cm 8 mm

A hat measures 16 mm. A head measures 13 mm.

8. 13 mm = 1 cm 3 mm
9. 16 mm = 1 cm 6 mm
10. How much too large is the hat? 3 mm

Topical Outline	Suggestions for Instructors
11. How much fence is needed to go around this flower garden? 49 m 2 dm 12. What is the difference in length between the longest side and the shortest side? 13 m 6 dm A piece of 35 mm movie film has 4 pictures. Each picture is 23 mm by 17 mm. 13. Each picture is how much longer than it is wide? 6 mm 14. Only 23 mm of the 35 mm width is used for a picture. How many millimeters of the width is not used for a picture? 12 mm 15. Notice that there is a 2 mm strip between pictures. How much film is used from Picture A to Picture B? 38 mm 16. How much film is used from A to C? 76 mm One model of a Pinto car has the following measurements: Width: 1 m 8 dm 1 cm Length: 4 m 9 dm Height: 1 m 4 dm 4 cm 17. This car is 3 m 0 dm 9 cm longer than it is wide. 18. This car is 3 dm 7 cm wider than it is high. 19. How long would two of these cars be when parked bumper to bumper? 9 m 8 dm 20. A highway sign was twice as tall as this car. How tall was the sign? 2 m 8 dm 8 cm	
G. Problems about Length (Handout II-7)	Review answers to Handout II-6.
1. Todd mailed a letter at the post office on his way to school. How far did he ride his bicycle on the way to school? 7 dam 3 m 2. He returned a book to the library on his way home. How far did he ride on his way home? 6 dam 6 m	

Topical Outline	Suggestions for Instructor
3. In problems 1 and 2, which trip was longer? first By how much? 7 m 4. Does Todd live closer to the library or the post office? library How much closer? 3 m	
Odometer readings in kilometers on Mr. Munro's car before and after a trip are: Before: 4263 After: 5001	
5. How long was the trip? 738 km 6. Mr. Munro made the trip in 9 hours. What was his average speed? 82 km per hour. 7. After driving 196 kilometers, he got on the tollway for the rest of the trip. How far did he drive on the tollway? 542 km	
8. Mr. Munro drove from Seattle to Chicago and then on to New York City. How far did he drive? 4690 km 9. Tonya Garman has to drive from Los Angeles to New York City. How much shorter is it to go direct than to go through Chicago? 30 km 10. How much farther is it from New York City to Miami than it is from New York City to Chicago? 790 km	Review the answers to Handout II-7.
IV. REVIEW OF THE SESSION	At the end of this session, ask participants to start thinking how they would think in metric concerning measurement of area. Review and summarize important points.

Handout II-1

METRIC UNITS OF LENGTH

Lay a centimeter ruler along an inch ruler.

1. Which is longer, a centimeter or an inch? ______________________________
2. 1 inch is about ________ centimeters.
3. 1 centimeter is about _________ inch.

Lay a millimeter ruler along a centimeter ruler.

4. 4 cm = _____ mm
6. 2 cm = _____ mm
5. 3 cm = _____ mm
7. 1 cm = _____ mm

Use the centimeter ruler to find the length of this line segment.

8. ____

9. 1 dm = _____ cm
10. 1 dm = _____ mm

Lay a meter stick along a yardstick.

11. 1 meter is about _____ cm longer than 1 yard.
12. 1 meter is about _____ inches longer than 1 yard.

Use the rulers and the meter stick to answer the following.

13. 1 m = _____ cm
14. 100 cm = _____ dm
15. 1000 mm = _____ m

Underline the fraction that makes each sentence true.

16. 1 decimeter is (1/10, 1/100, 1/1000) of a meter.
17. 1 centimeter is (1/10, 1/100, 1/1000) of a meter.
18. 1 millimeter is (1/10, 1/100, 1/1000) of a meter.

Answer the following.

19. Ron ran 45 yards. Cathy ran 45 meters. Who ran farther? ______________

    How do you Know? ____

20. A spider went 9 cm. An ant went 9 inches. Which went farther? __________

    How do you know? ____

Handout II-2

METRIC UNITS OF LENGTH

1. 1 dam = _____ m

2. 2 dam = _____ m

3. 7 dam = _____ m

4. 30 m = _____ dam

5. 80 m = _____ dam

6. 100 m = _____ dam

7. 1 hectometer is about ____________ meters longer than 100 yards.

8. 10 m = _____ dam

9. 100 m = _____ hm

10. 100 m = _____ dam

11. 2 hm = _____ m

12. 7 hm = _____ m

13. 10 hm = _____ m

14. 2 km = _____ m

15. 9 km = _____ m

16. 13 km = _____ m

17. 3000m = _____ km

18. 7000 m = _____ km

19. 23000 m = _____ km

COMPLETE THE TABLE AS SHOWN.

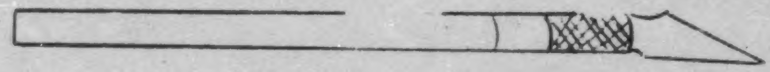
Metric Units of Length

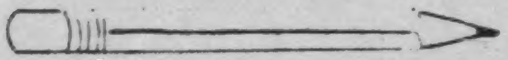
EX.	kilometer	km	1000	m
20.	hectometer	_____	_________	m
21.	dekameter	_____	_________	m
22.	meter	_____	_________	m
23.	decimeter	_____	_________	m
24.	centimeter	_____	_________	m
25.	millimeter	_____	_________	m

Handout II-3

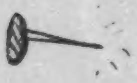
ESTIMATING AND MEASURING

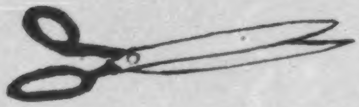
Estimate the length of each object in centimeters. Then find the length of each object to the nearest centimeter.

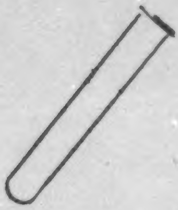
1. 

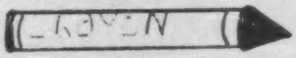
2. 

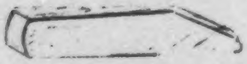
3.

4. 

5. 

6. 

7. 

8. 

Estimate	Measurement
____ cm	____ cm
____ cm	____ cm
____ cm	____ cm
____ cm	____ cm
____ cm	____ cm
____ cm	____ cm
____ cm	____ cm
____ cm	____ cm

Estimate each of the following to the nearest meter. Use a meter stick to find each to the nearest meter.

9. the height of a door

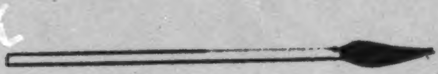
10. the length of your classroom

11. the width of your classroom

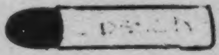
Estimate	Measurement
____ m	____ m
____ m	____ m
____ m	____ m

Estimate the length of each object in millimeters. Then find the length to the nearest millimeter. Record each measurement in two ways as shown in the table.

12.



13.



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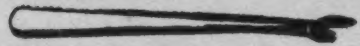

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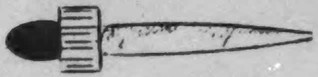
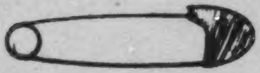


16.



Estimate	Measurement
____mm	____cm ____mm
____mm	____cm ____mm
____mm	____cm ____mm
____mm	____cm ____mm
____mm	____cm ____mm

Use the millimeter ruler to draw line segments of the following lengths.

17. 16 cm

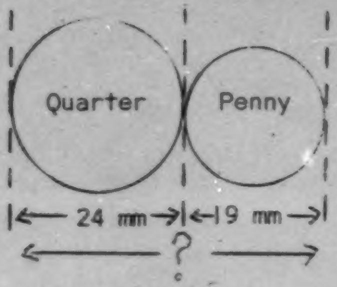
18. 97 mm

19. 5 cm 8 mm

20. 13 cm 4 mm

Handout II-4

ADDING METRIC MEASURES



Tanya found the distance across a quarter.
Bob found the distance across a penny.
They laid the coins beside each other as shown.
How can they find the distance across both coins?

1. The distance is _____ mm.

2. Tanya and Bob could have given the measurements as follows:

24 mm = _____ cm _____ mm

3. 19 mm = _____ cm _____ mm

*Then the measures could be added.

FIND EACH SUM.

4. 54 mm
+ 27 mm

5. 18 mm
+ 36 mm

6. 43 mm
+ 37 mm

7. 2 cm 8 mm
+(3 cm 3 mm)

8. 7 cm 5 mm
+(1 cm 7 mm)

9. 4 cm 9 mm
+(2 cm 8 mm)

10. 16 cm
+ 47 cm
cm or ___ dm ___ cm

11. 38 cm
+ 15 cm
cm or ___ dm ___ cm

12. 54 cm
+ 39 cm
cm or ___ dm ___ cm

13. 3 m 4 dm 6 cm
+(2 m 5 dm 2 cm)

14. 4 m 1 dm 2 cm
+(3 m 4 dm 9 cm)

15. 1 m 6 dm 3 cm
+(6 m 4 dm 8 cm)

16. 6 dm 3 cm 4 mm
+(2 dm 5 cm 7 mm)

17. 4 dm 6 cm 5 mm
+(2 dm 4 cm 8 mm)

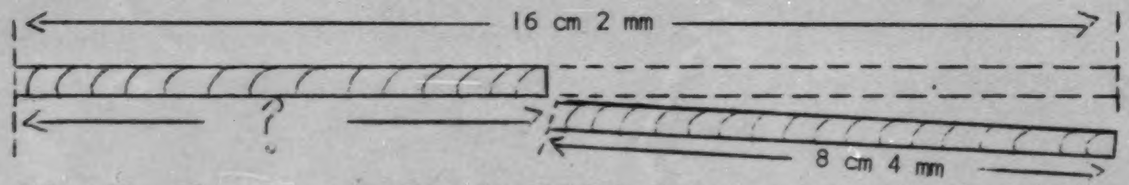
18. 4 dam 3 m 8 dm
+(2 dam 6 m 1 dm)

19. 6 dam 7 m 6 dm
+(1 dam 1 m 5 dm)

20. 3 dam 8 m 4 dm
+(5 dam 3 m 9 dm)

Handout II-5

SUBTRACTING METRIC MEASURES



A ribbon 16 cm 2 mm was cut. The piece cut is 8 cm 4 mm long. How long is the piece that is left?

1. Its length is ____ cm ____ mm.
2. Another way is to subtract the measures. Can you subtract 16 cm 2 mm the 4
-(8 cm 4 mm) from 2??

3. Rename 16 cm 2 mm as 15 cm ___ mm.

FIND EACH DIFFERENCE.

4. 32 cm
- 17 cm

5. 44 mm
- 25 mm

6. 66 m
- 47 m

7. 9 cm 3 mm
-(4 cm 2 mm)

8. 8 cm 4 mm
-(5 cm 7 mm)

9. 7 cm 3 mm
-(6 cm 5 mm)

10. 5 dm 1 cm
-(1 dm 4 cm)

11. 4 m 8 dm
-(2 m 9 dm)

12. 17 m 6 dm
-(9 m 8 dm)

13. 6 dm 7 cm 3 mm
-(2 dm 4 cm 8 mm)

14. 4 dm 3 cm 9 mm
-(1 dm 6 cm 7 mm)

15. 8 dm 1 cm 2 mm
-(3 dm 5 cm 4 mm)

16. 5 m 8 dm 3 cm
-(2 m 7 dm 6 cm)

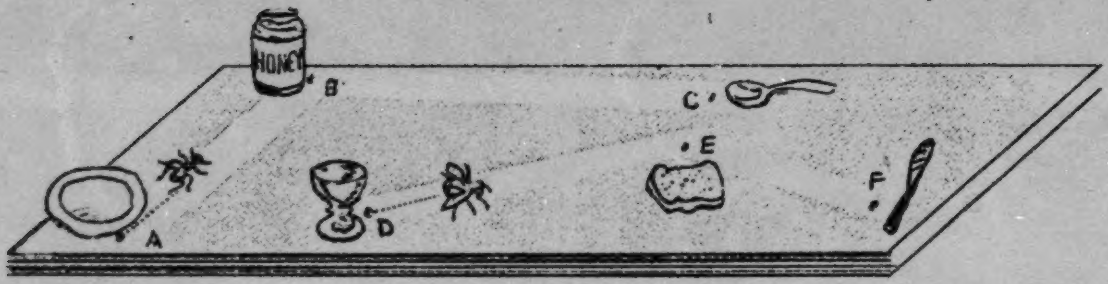
17. 6 dam 3 m 9 dm
-(2 dam 5 m 7 dm)

18. 8 dam 4 m 7 dm
-(6 dam 8 m 9 dm)

19. 7 hm 5 dam 6 m
-(4 hm 3 dam 8 m)

20. 5 km 8 hm 4 dam
-(2 km 9 hm 2 dam)

PROBLEMS ABOUT LENGTH



Use a millimeter ruler to find how far the ant traveled.

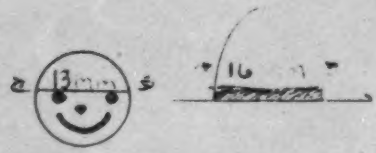
1. from A to B ____ cm ____ mm
2. from B to C ____ cm ____ mm
3. from A to B to C ____ cm ____ mm

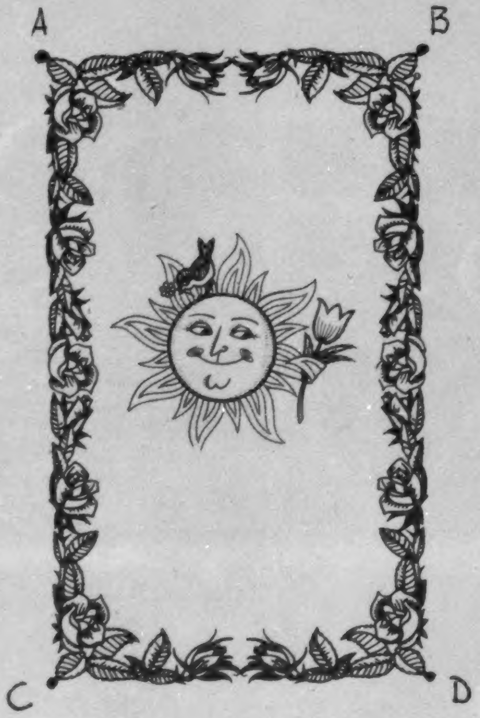
Do the same to find how far the fly traveled.

4. from D to E ____ cm ____ mm
5. from E to F ____ cm ____ mm
6. from D to E to F ____ cm ____ mm
7. Did the ant or the fly travel farther? ______ How much farther? ___ cm ___ mm

8. 13 mm = ____ cm ____ mm
9. 16 mm = ____ cm ____ mm

10. How much too large is the hat? ____ mm

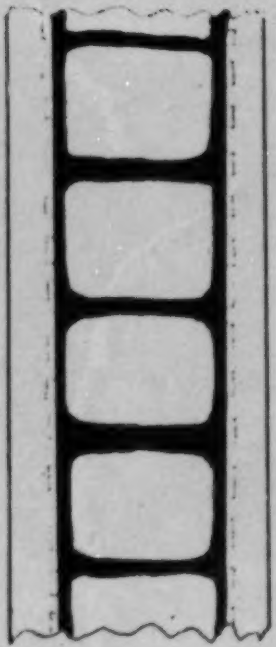




11. How much fence is needed to go around this flower garden?
____m ____ dm

12. What is the difference in length between the longest side and the shortest side?
____ dm

A piece of 35 mm movie film is shown. Each picture is 23 mm by 17 mm.



13. Each picture is how much longer than it is wide?

____ m

14. Only 23 mm of the 5 mm width is used for a picture. How many millimeters of the width is not used for a picture?

____ mm

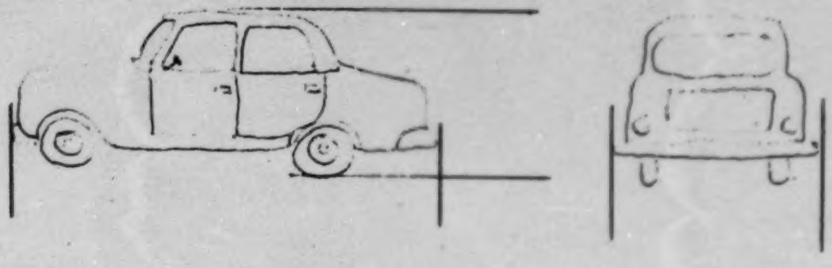
15. Notice that there is a 2 mm strip between pictures. How much film is used from A to B?

____ mm

16. How much film is used from A to C?

____ mm

One model of a Pinto car has the measurements shown below:



17. This car is ____ m ____ dm ____ cm longer than it is wide.

18. This car is ____ dm ____ cm wider than it is high.

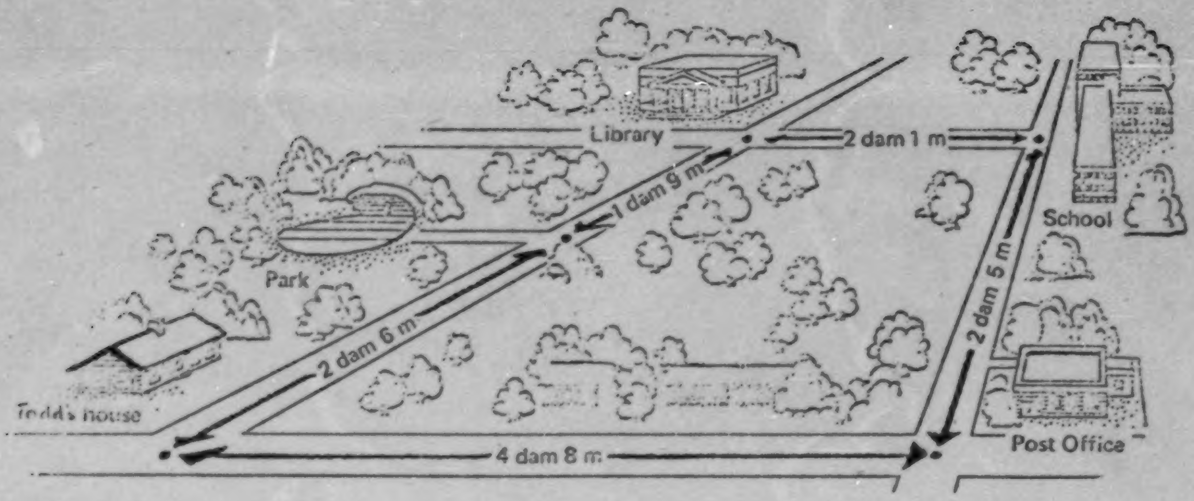
19. How long would 2 of these cars be when parked bumper to bumper? ____ m ____ dm

20. A highway sign was twice as tall as this car. How tall was the sign?

____ m ____ dm ____ cm

Handout II-7

PROBLEMS ABOUT LENGTH


Library
2 dam 1 m
1 dam 9 m
School
Park
2 dam 5 m
2 dam 6 m
Todd's house
Post Office
4 dam 8 m

1. Todd mailed a letter at the post office on his way to school. How far did he ride his bicycle on the way to school?

____ dam ____ m

2. He returned a book to the library on his way home from school. How far did he ride on his way home?

____ dam ____ m

3. In problems 1 and 2, which trip was longer? ____________ How much? ____ m

4. Does Todd live closer to the library or the post office? ____________________ How much closer? ____ m

Shown below are the odometer readings in kilometers on Mr. Munro's car before and after a trip.

BEFORE	AFTER
4263	5001

5. How long was the trip? ____ km

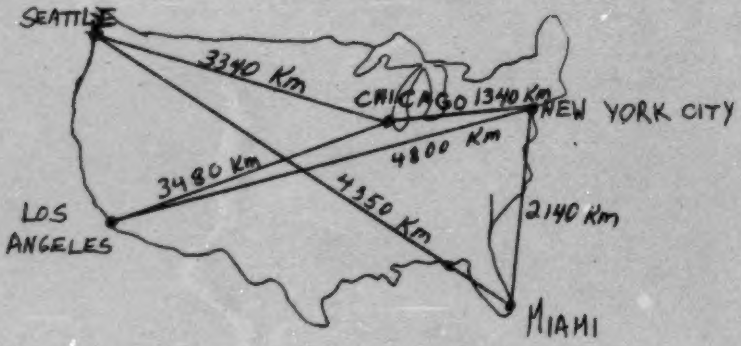
6. Mr. Munro made the trip in 9 hours. What was his average speed?

_____ km per hour

7. After driving 196 kilometers, he got on the tollway for the rest of the trip. How far did he drive on the tollway?

____ km

Distances between some cities are shown on the map:


SEATTLE
3340 Km
CHICAGO
1340 Km
NEW YORK CITY
4800 Km
3480 Km
4350 Km
2140 Km
LOS ANGELES
MIAMI

8. Mr. Munro drove from Seattle to Chicago and then on to New York City. How far did he drive?

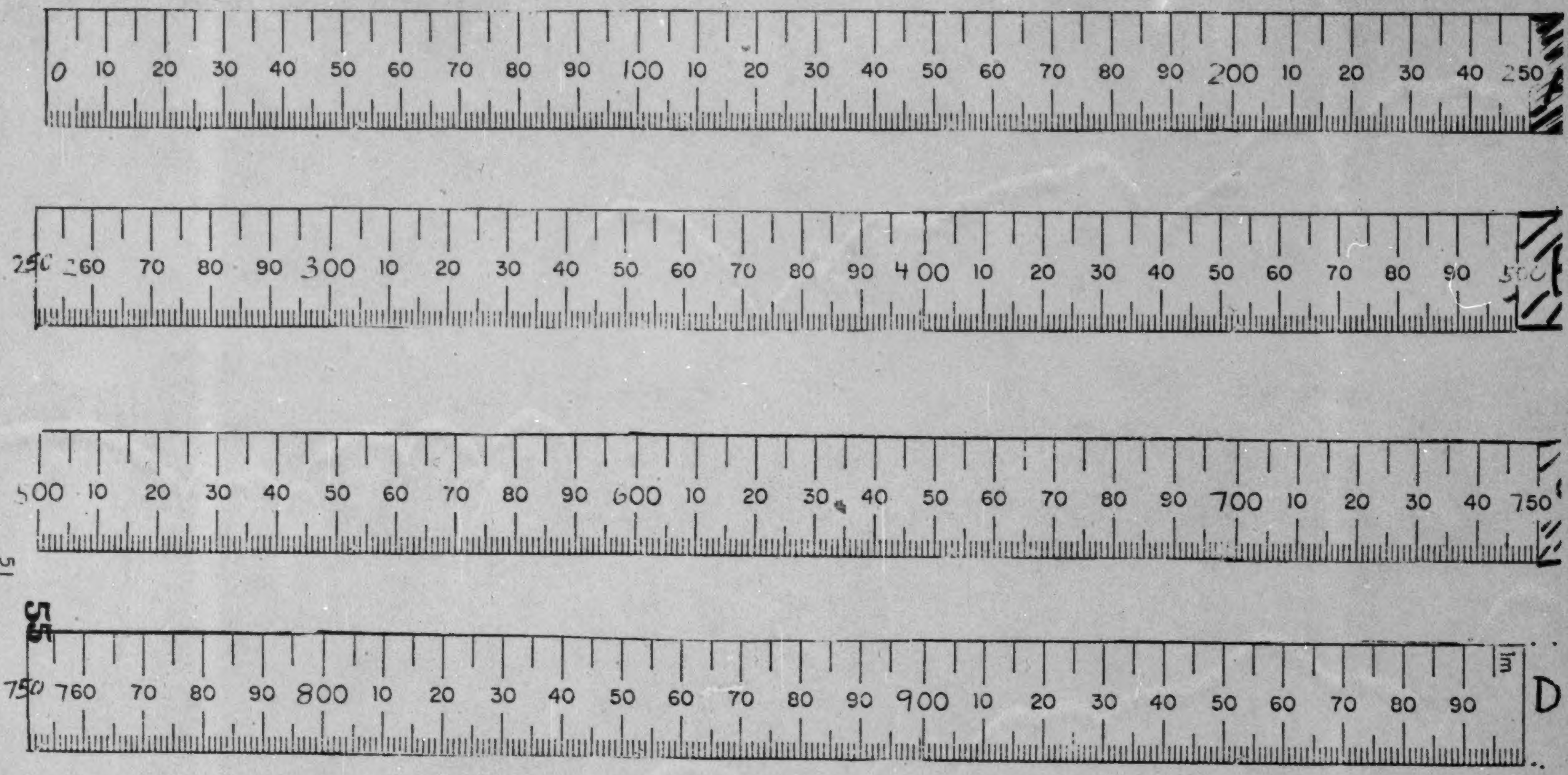
______ km

9. Tanya Garman has to drive from Los Angeles to New York City. How much shorter is it to go direct than to go through Chicago?

______ km

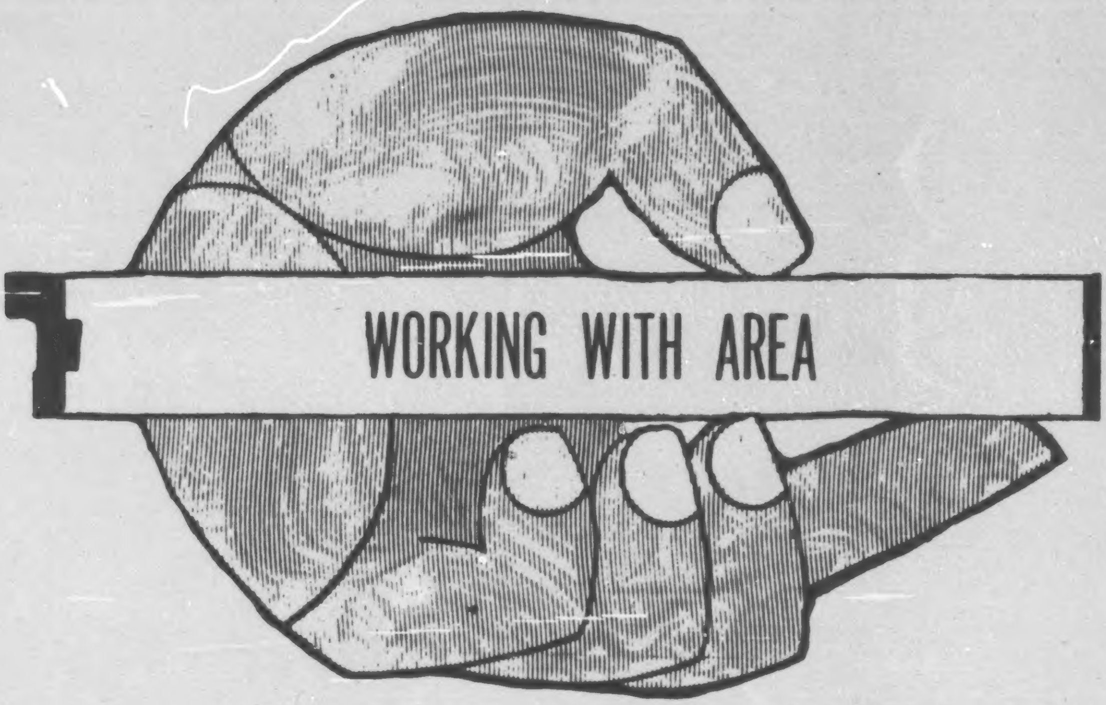
10. How much farther is it from New York City to Miami than it is from New York City to Chicago?

______ km


0 10 20 30 40 50 60 70 80 90 100 10 20 30 40 50 60 70 80 90 200 10 20 30 40 250
250 260 70 80 90 300 10 20 30 40 50 60 70 80 90 400 10 20 30 40 50 60 70 80 90 500
500 10 20 30 40 50 60 70 80 90 600 10 20 30 40 50 60 70 80 90 700 10 20 30 40 750
750 760 70 80 90 800 10 20 30 40 50 60 70 80 90 900 10 20 30 40 50 60 70 80 90 1m
D

Directions: To make a metric ruler which includes a total meter and its parts, you will need to cut out sections A, B, C, and D. Overlap each section in order (A,B,C,D) and tape the ruler together.

SESSION III:


WORKING WITH AREA

Topical Outline	Suggestions for Instructor
I. REVIEW Answers to Review of Length (Handout III-1) 1. 10 dm 2. 100 cm 3. 1000 mm 4. 10 cm 5. 10 mm 6. 10 hm 7. 100 dam 8. 1000 m 9. 10 dam 10. 10 m 11. 6 cm or 63 mm 12. 5 cm or 47 mm 13. 10 cm or 96 mm 14. 9 cm or 88 mm 15. 5 m 8 dm 1 cm 16. 7 dm 3 cm 4 mm 17. 4 m 6 dm 3 cm 18. 1 dm 8 cm 4 mm 19. 8 cm 2 mm 20. 5 dm 6 cm	Pass out Handout III-1. This can be used as a quiz or review.
Metric system comes from the word meter, the principal unit of Length. The scale of multiples and subdivisions of the meter is ten (10). All units of surface, volume, capacity, and weight are directly derived from the meter. Divisions of the main units are tenths, hundredths, thousands. They are formed by adding Latin prefixes. Example:	Discuss.
deci means one-tenth (.1) centi means one-hundredth (.01) milli means one-thousandth (.001)	Put on chalkboard.
Higher units are formed using Greek prefixes and multiplying the basic unit by 10, 100, 1000, etc. Example:	
deca means 10 hecto means 100 kilo means 1000	Put on chalkboard.
Problems 1 mm = .001 1 dm = .01 m 1 hm = .1 m 1 cm = 10 m 1 dkm = 100 m 1 km = 1000 m	

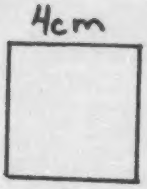
Topical Outline	Suggestions for Instructor

II. METRIC AREA

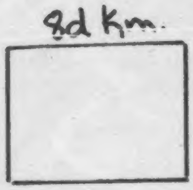
In measuring area, we use the square meter (not meter square). This is used for land plots, floor space, wall space. The rules are the same as our U.S. system.

When using the metric system, you will need to be able to measure more than the length from one end to another...such as for storage, for display, for layout in your business operations, etc.

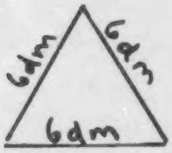
The perimeter of an area is simply the distance around the outside edges. It is the sum of the distance along each side, just as we have always figured in the past.



A.

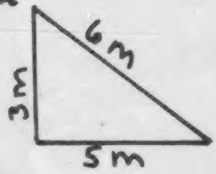


B

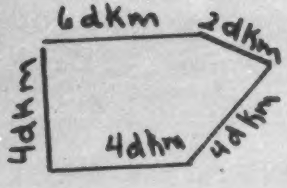


C

D

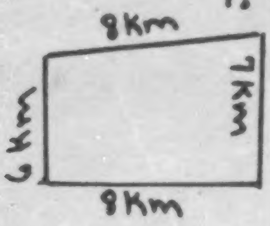


Topical Outline	Suggestions for Instructor



E.

F.

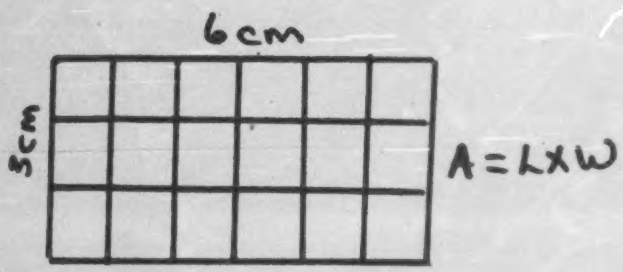


A. What is the perimeter of this square? 16 cm
B. What is the perimeter of this rectangle? 24 km
C. What is the perimeter of this triangle? 18 cm
D. What is the perimeter of this triangle? 14 m
E. What is the perimeter of this 4-sided polygon? 20 dkm
F. What is the perimeter of this 5-sided polygon? 29 km

III. AREA OF RECTANGLES

To measure the space in a flat area, you simply are defining the size of the area inside the perimeters, such as teh space a rug covers, a poster, or a city block.

The square centimeter is one of the standard units used in measuring the area of such a figure. How many square centimeters are in this rectangle? (18 cm)



Show transparencies III-1,2

Make transparencies or draw figure on chalkboards.

Topical Outline

How did you figure it out?

The hardest way to do it is to count the blocks. You will get the same answer by multiplying one side times the other: 3 x 6 = 18

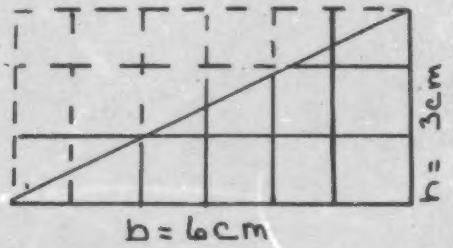
2. Find the area of the following rectangles.

	Length	Width	Area
A.	12 cm	8 cm	96 sq. cm
B.	15 hm	10 hm	150 sq. hm
C.	16 cm	7 cm	112 sq. cm
D.	22 dm	8 dm	176 sq. dm
E.	13 km	5 km	65 sq. km
F.	14 mm	3 mm	42 sq. mm
G.	24 dm	13 dm	312 sq. dm

IV. AREA OF TRIANGLES

1. The area of a triangle is the measure of the region inside the triangle. The area of a triangle is 1/2 the area of a parallelogram with the same base and height. What is the area of the triangle at the bottom?

9 cm



A = 1/2 bh

How did you get the answer?

Counting the blocks you come up with the correct answer. However, isn't it easier to multiply the height x the width and cut it in half.

Suggestions for Instructor

Ask

Put the length x width problems on the chalkboard. Check to be sure the participants are getting the right answer.

Make transparencies or draw figure on chalkboards.

Topical Outline	Suggestions for Instructor

2. Find the area of the following triangles.

	Base	Height	Area
A.	8 cm	4 cm	16 sq. cm
B.	10 m	6 m	30 sq. m
C.	15 dm	10 dm	75 sq. dm
D.	7 km	4 km	14 sq. km
E.	16 cm	7 cm	56 sq. cm
F.	22 dm	8 dm	88 sq. dm
G.	5 m	4 m	10 sq. m

Put on chalkboard.

V. UNEVEN NUMBERS

1. One of the problems with the current system of measuring is that it is difficult to multiply uneven numbers. For example, how do you multiply 10 1/3 ft. times 2 3/4 ft. You would have to work with fractions, converting them to equals, in this case 12ths.

   The metric system has an easy answer to this problem.

2. Let's say a table top measures 1 m 8 dm by 2 m 6 dm. What common numbers could be used to measure the area of the table top?

   1 m 8 dm = 18 dm
   2 m 6 dm = 26 dm

   It is strictly a matter of moving the decimal point. To change meters to decimeters, you are multiplying by 10.

3. Convert the following to common metric measure before multiplying:

*1 m 4 dm x 2 m 2 dm (14 dm x 22 dm)
*6 dm 10 cm x 2 dm 1 cm (70 cm x 21 cm)
*1 cm 10 mm x 2 cm 10 mm (110 mm x 210 mm)
*1 km 200 m x 1 km 10 m (1200 m x 1010 m)

Topical Outline	Suggestions for Instructor
VI. HECTARE VERSUS ACRES A special unit of area is used in measuring land called the hectare, which is equivalent to a square 100 meters by 100 meters. It is an area two and one half times as big as an acre. The symbol for hectare is (ha).	NOTE: If participants deal with real estate this point should be covered.
VII. HANDOUTS Pass out the handouts to participants. Give them enough time to work the problems. Go over with them and explain. Handout III-2 1. 4,8 2. 6,5 3. 8,3 4. 19,6 5. 21 6. 34 7. 21 8. 34 9. 110 10. 2,3 11. 2,3 12. 3,2 13. 5,5 14. 13,3 15. 6,7 16. 212 17. 15,6 18. 73,2 19. 86,4 20. 16 Handout III-3 1. sq. mm 2. sq. dm 3. 100 (10 x 10) 4. 100 (10 x 10) 5. 6 6. 15 7. 8 8. 8 9. 9 10. 15 Handout III-4 1. 6 2. 4 3. 24 4. 4 5. 6 6. 24 7. 24 8. 588 9. 550 10. 54 11. 319 12. 5888 13. 252000 14. 319 15. 19 16. 15 17. 1 18. 4 19. 16 20. 4 times greater	Pass out the following handouts to participants.
VIII. REVIEW OF THE SESSION	Ask for questions, if there are none, tell participants they will work with Volume next session.

Handout III-1

Complete the following.

1. 1 m = ______ dm

2. 1 m = ______ cm

3. 1 m = ______ mm

4. 1 dm = ______ cm

5. 1 cm = ______ mm

6. 1 km = ______ hm

7. 1 km = ______ dam

8. 1 km = ______ m

9. 1 hm = ______ dam

10. 1 dam = ______ m

Measure each segment to the nearest centimeter, and then the nearest millimeter.

11. ______________________________ ___ cm or ___ mm

12. ________________________ ___ cm or ___ mm

13. ____ ___ cm or ___ mm

14. ____ ___ cm or ___ mm

Find each sum or difference.

15. 3 m 6 dm 4 cm
+(2 m 1 dm 7 cm)

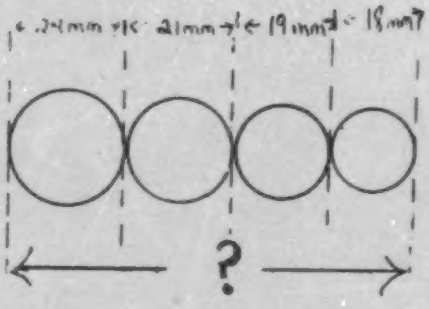
17. 8 m 3 dm 4 cm
-(3 m 7 dm 1 cm)

16. 5 dm 7 cm 6 mm
+(1 dm 5 cm 8 mm)

18. 6 dm 2 cm 3 mm
-(4 dm 3 cm 9 mm)

19. How far is it across all four coins?

____ cm ____ mm



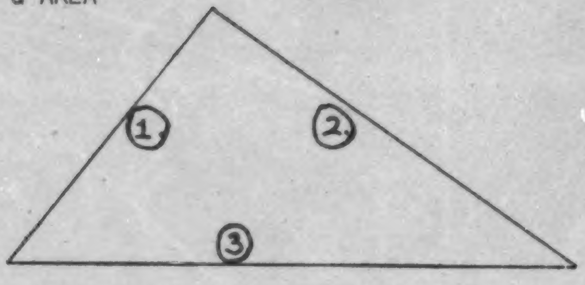
20. Todd jumped 6 m 5 dm 6 cm.
Jose jumped 7 m 1 dm 2 cm.
How much farther did Jose jump?

____ dm ____ cm

Handout III-2

PERIMETER & AREA

Measure each side of the triangle.



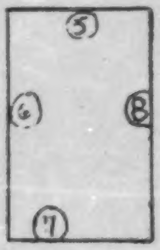
1. ____ cm ____ mm

2. ____ cm ____ mm

3. ____ cm ____ mm

4. How far is it around the triangle? ____ cm ____ mm

Measure each side. Then find the perimeter of each figure.



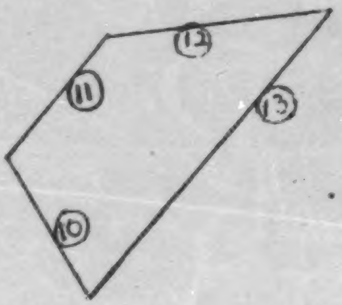
5. ____ mm

6. ____ mm

7. ____ mm

8. ____ mm

Perimeter is ____ mm.



10. ____ cm ____ mm

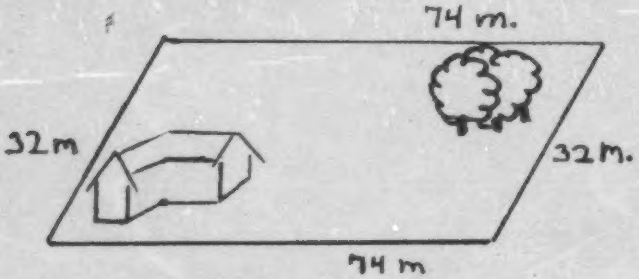
11. ____ cm ____ mm

12. ____ cm ____ mm

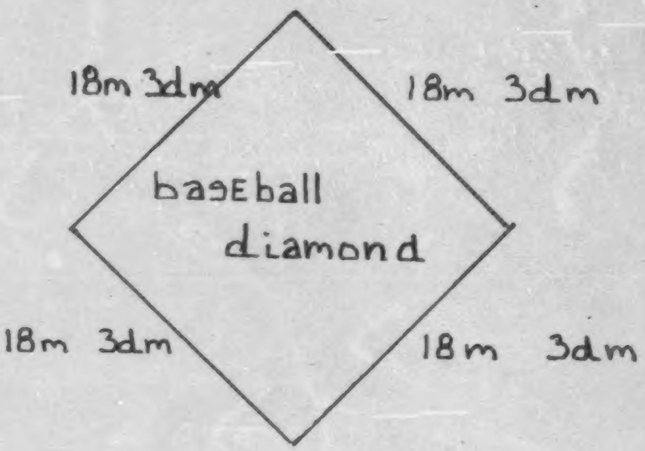
13. ____ cm ____ mm

14. Perimeter is ____ cm ____ mm

The lengths of the sides are given.
Find the perimeter of each figure.

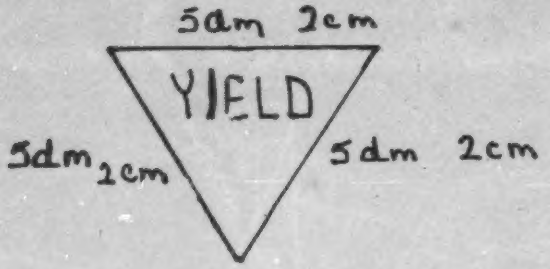

74 m.
32m
32m.
74 m

15. ____ m

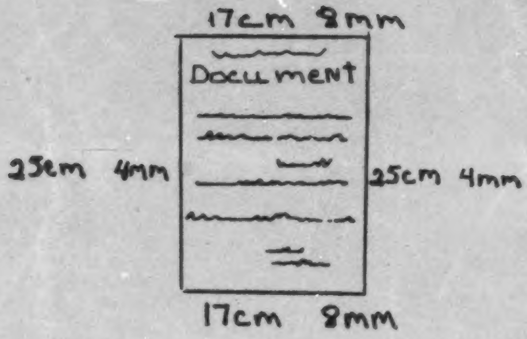

18m 3dm
18m 3dm
baseball
diamond
18m 3dm
18m 3dm

17. ____ m ____ dm

Cont. Handout III-2


5dm 2cm
YIELD
5dm 2cm
5dm 2cm

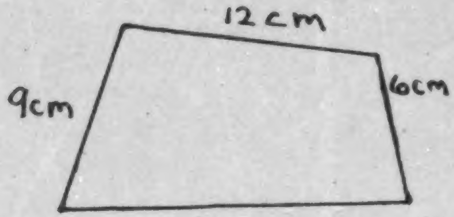
16. ____ dm ____ cm


17cm 8mm
DOCUMENT
25cm 4mm
25cm 4mm
17cm 8mm

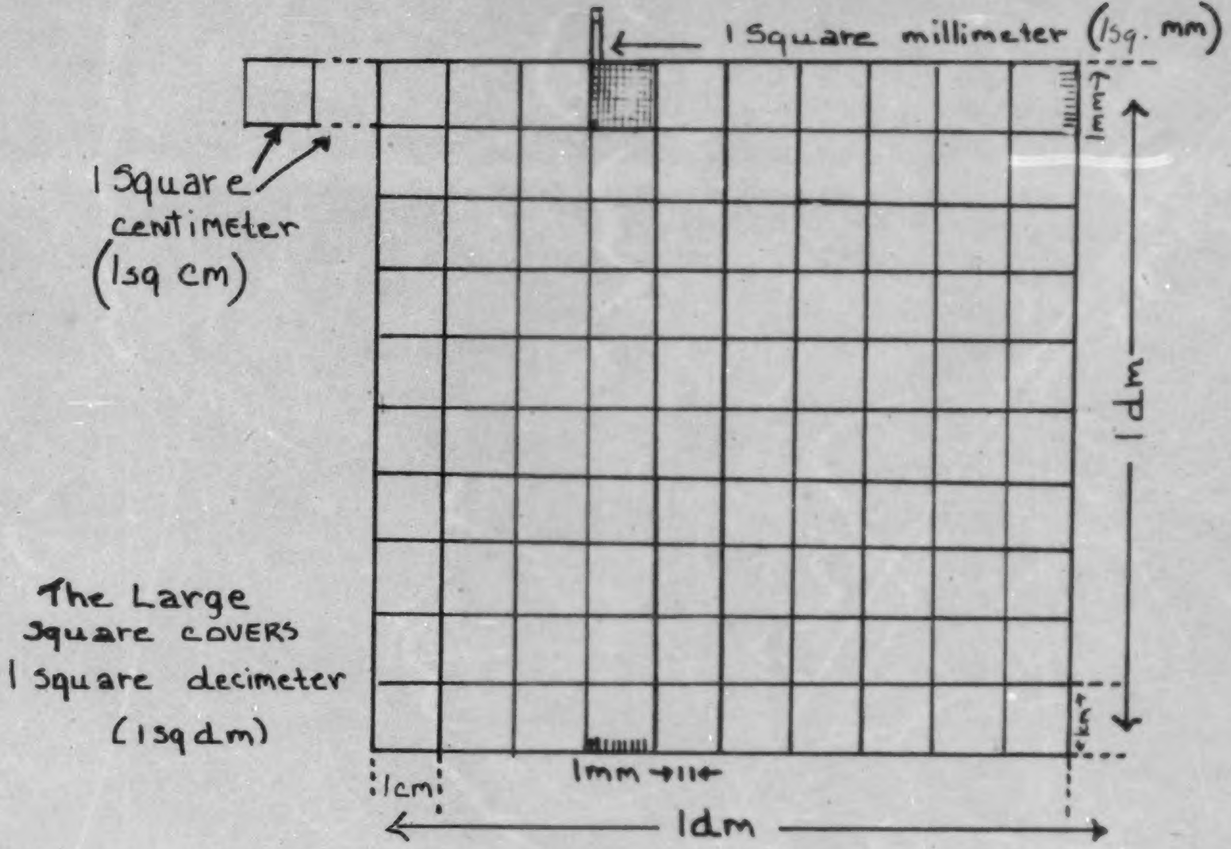
19. ____ cm ____ mm

The perimeter is given. Find the missing length.

Perimeter is 43 cm


12 cm
9cm
6cm

20. ____ cm

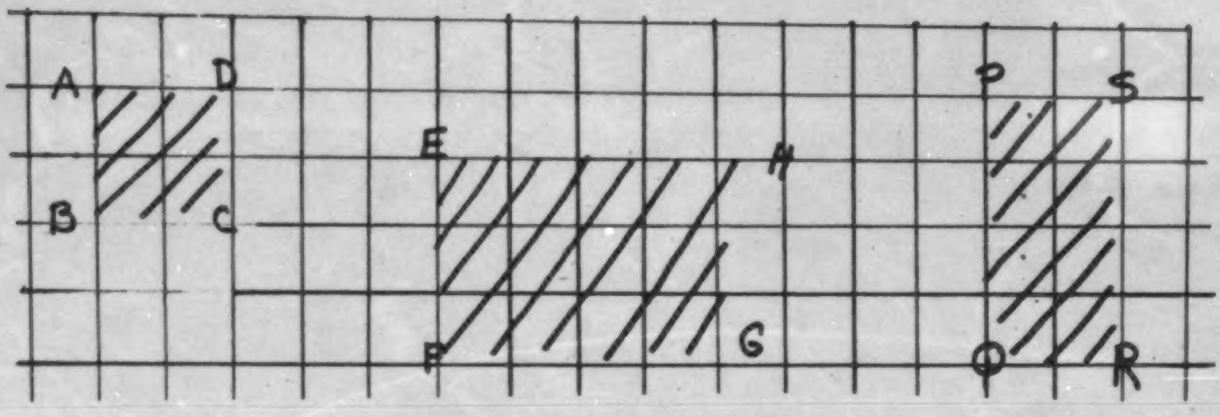

1 Square millimeter (1sq. mm)
1 Square centimeter (1sq cm)
1mm
1dm
The Large Square COVERS 1 Square decimeter (1sq dm)
1mm
1cm
1mm
1dm

1. You can write square millimeter as ________________.

2. You can write square decimeter as ________________.

3. 1 sq cm = ____ sq mm

4. 1 sq dm = ____ sq cm

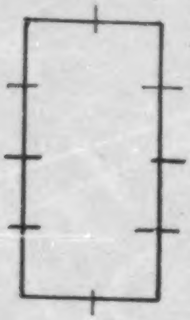


5. How many sq cm are needed to cover the inside of rectangle ABCD? _____ sq cm

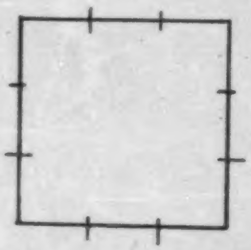
6. What is the area of rectangle EFGH? _____ sq cm

7. What is the area of rectangle PQRS? _____ sq cm

The sides of the rectangles below are marked in centimeters. Find the area of each rectangle. (Draw lines to form sq cm if necessary.)

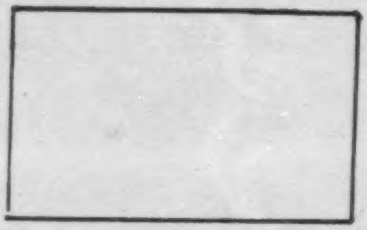


8. _____ sq cm



9. _____ sq cm

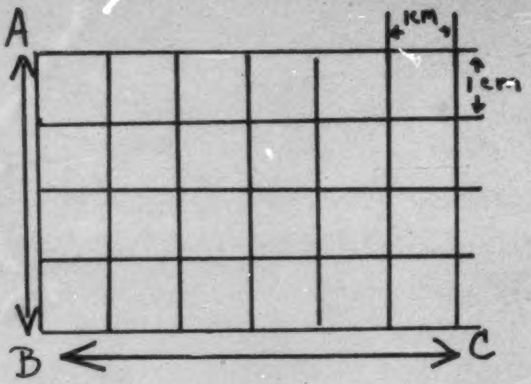
Measure the sides of the rectangle below. Find the area of the rectangle.



10. _____ sq cm

Handout III-4

Area of a Rectangle

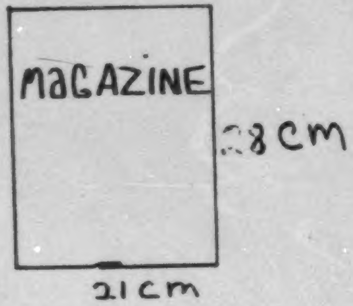


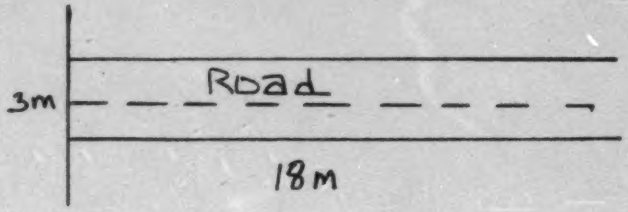
Answer the following for this rectangle.

1. How many horizontal rows of sq cm? _____
2. How many vertical sq cm in each row? _____
3. How many sq cm in the rectangle? _____
4. How long is side AB? _____ cm
5. How long is side BC? _____ cm
6. 4 X 6 = _____
7. What is the area of the rectangle? _____ sq cm

If a rectangle is a units wide and b units long, its area is a X b square units.

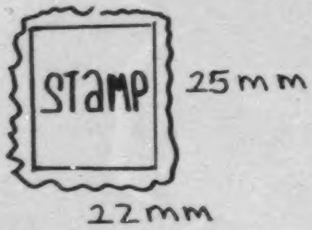
Find the area of each figure below.

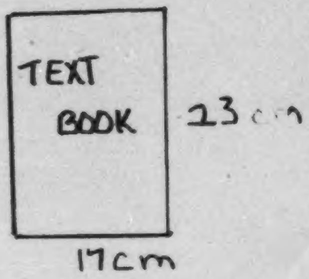

MAGAZINE
28 cm
21 cm



8. _____ sq cm

10. _____ sq m

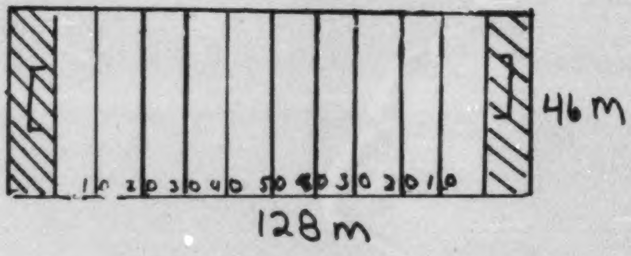

STAMP
25 mm
22 mm


TEXT
BOOK
23 cm
17 cm

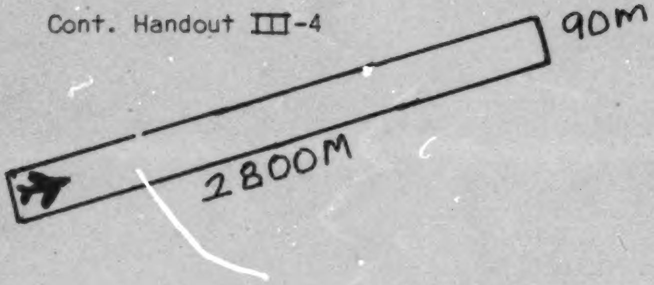
9. _____ sq mm

11. _____ sq cm

12. A football field is about the size given. Find the area of the football field.


10 20 30 40 50 40 30 20 10
46 m
128 m

Cont. Handout III-4

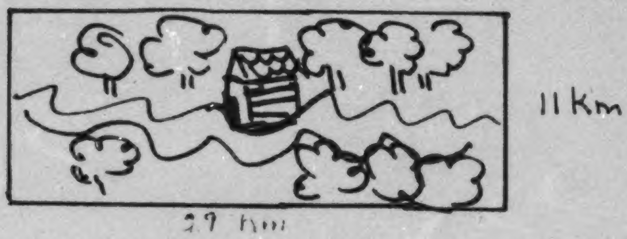


13. A runway at an airport is shown. What is the area of the runway?

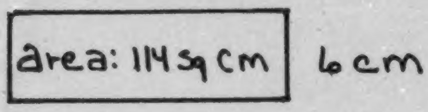
_________ sq m

14. A rectangular state park has the size given. Find the area of the park.

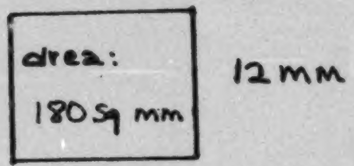
_________ sq km



The area of each rectangle is given below. Find the missing length.

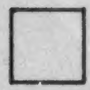

area: 114 sq cm
6 cm

15. _____ cm

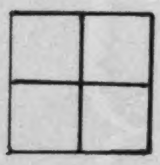

area:
180 sq mm
12 mm

16. _____ mm

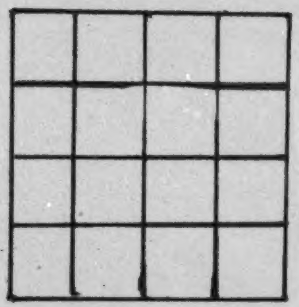
Find the area of each square shown below.



17. _____ sq cm



18. _____ sq cm

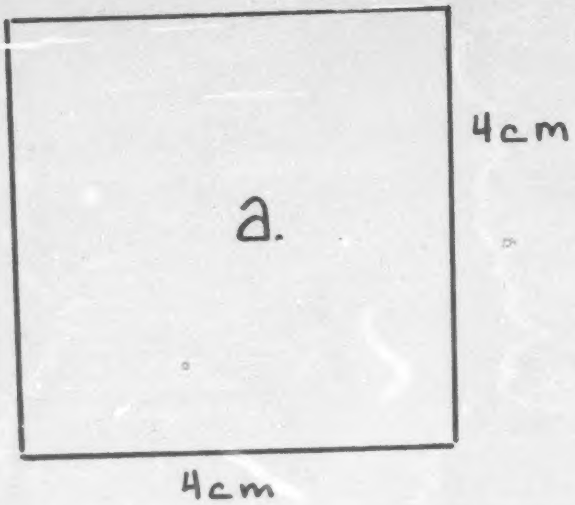


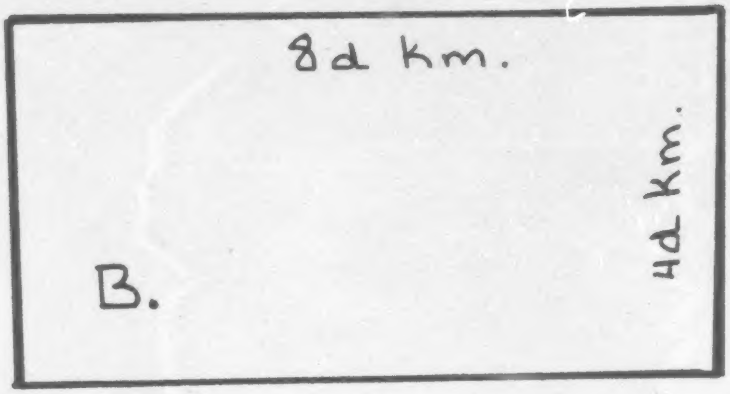
19. _____ sq cm

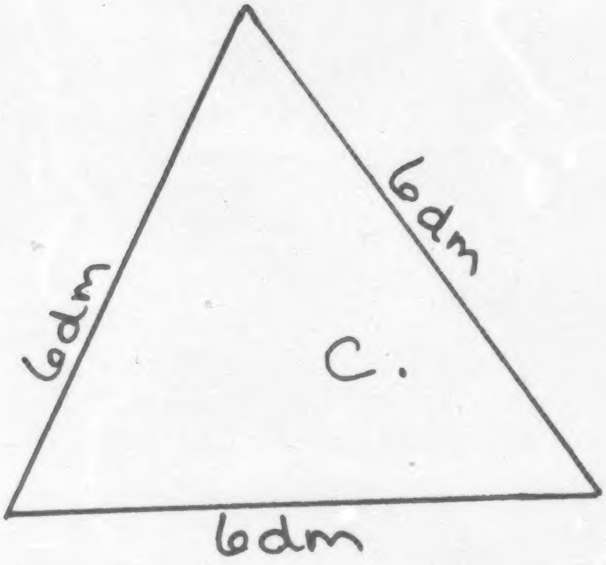
20. What happens to the area of a square when you double the length of its sides?

____

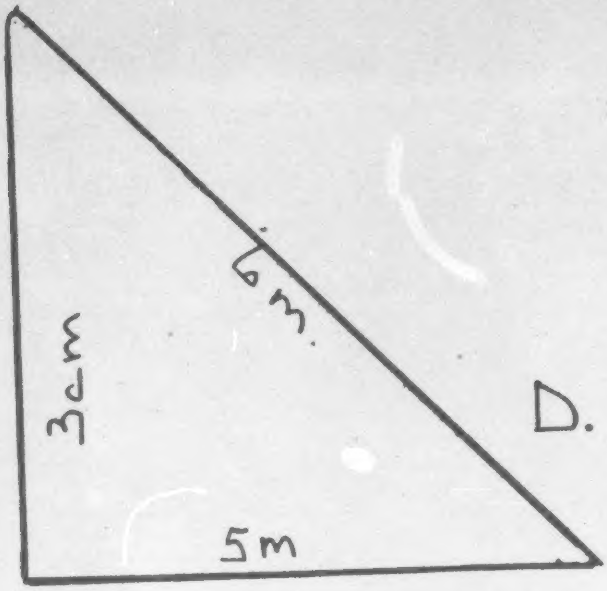
Transparency III-1



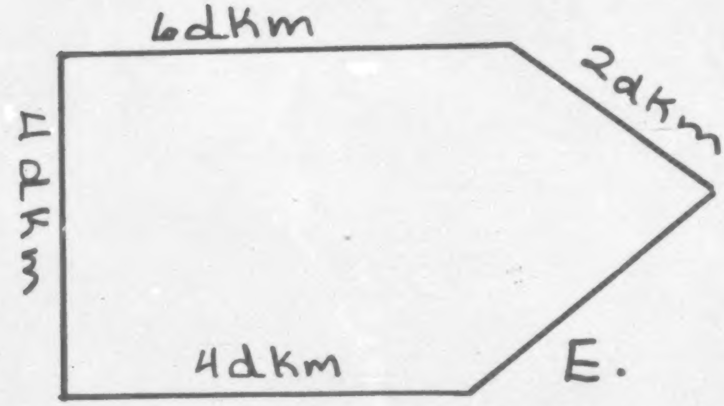



6dm
6dm
C.
6dm

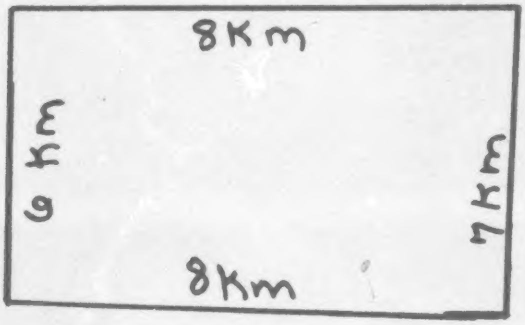
Transparency III-2



D.

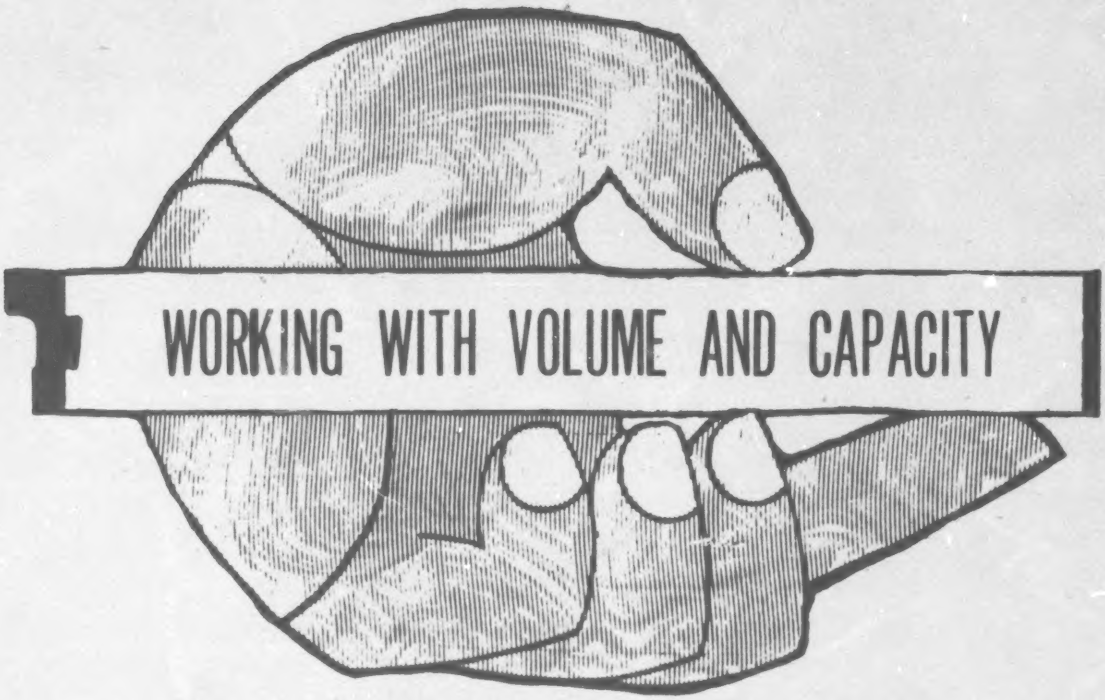

6dKm
2dKm
4dKm
4dKm

E.


8Km
6Km
7Km
8Km

F.

SESSION IV:



WORKING WITH VOLUME AND CAPACITY

Topical Outline	Suggestions for Instructor
I. REVIEW	Review last session. Use Handout IV-1 as a quiz or summary.
A. Answers to Handout IV-1: 1. 23 2. 32 3. 11,8 4. 26 5. 21 6. 840 7. 729 8. 391 9. 696 10. 300	
B. The proper way to learn the metric system is to live metric and metric only whenever possible, using only those measurement units necessary at a given time. Do not try to absorb the entire system until the basic units become second nature in use. By gradually increasing the use of the metric system in this manner, the relationship of the units, within the system itself, becomes readily apparent.	
C. The most commonly used units of the metric system are: meter for length liter for volume kilogram for mass	Put on chalkboard.
D. Common Multiples (Prefixes) kilo = 1,000 x base unit centi = .01 x base unit milli = .001 x base unit	
II. METRIC VOLUME	
The units of area of volume (or capacity) are directly obtained from the unit of length.	Lecture Hand out the following problems and work with the participants in filling them out. (Handouts IV-2 through IV-6)

Topical Outline	Suggestions for Instructor
Handout IV-2 1. 6 2. 12 3. 12 4. 1cc 5. 100 6. 10 7. 1000 8. 8 9. 6 10. 12	Answers to problems.
Handout IV-3 1. 10 2. 1000 (10 x 10 x 10) 3. 1 4. 10 5. 1000 (10 x 10 x 10) 6. 240 7. 270 8. 24; 24000 9. 189 10. 750	
Handout IV-4 1. 1 liter 2. Yes 3. No 4. No, 1 liter is more than 1 quart. 5. 1000 6. 100 7. 10 8. 1/10 9. 1/100 10. 1/1000	
Handout IV-5 1. 27 2. 54 3. 8 4. 12 5. 6 6. 1 7. No 8. 2 by 3 by 4 9. 1 by 1 by 24	Note: You will need to provide at least 24 sugar cubes, dice, or wooden blocks.
III. METRIC LIQUID A. This use of measurement works directly in with the metric mass. It is simply measurement of what is in the container. Liter is the basic unit in liquid measurement.	This was discussed in last session. It will be somewhat of a review.

Topical Outline	Suggestions for Instructor
1 kiloliter (kl.) = 1000 liters 1 hectoliter (hl.) = 100 liters 1 decaliter (dkl.) = 10 liters 1 deciliter (dl.) = 1/10 liter 1 centiliter (cl.) = 1/100 liter 1 milliliter (ml.) = 1/1000 liter	List on chalkboard
B. Make these number sentences true: 1. 10 liters = 1 dkl. 20 liters = 2 dkl. 30 liters = 3 dkl. 2. 100 liters = 1 hl. 200 liters = 2 hl. 300 liters = 3 hl. 3. 1000 liters = 1 kl. 2000 liters = 2 kl. 3000 liters = 3 kl. 4. 1 dl. = 1/10 liter 2 dl. = 2/10 or 1/5 liter 3 dl. = 3/10 liter 5. 1 cl. = 1/100 liter 2 cl. = 2/100 or 1/50 liter 3 cl. = 3/100 liter 6. 1 ml. = 1/1000 liter 2 ml. = 2/1000 or 1/500 liter 3 ml. = 3/1000 liter	Have these on chalkboard. Cover over with posterpaper until the instructor is ready to use. Work these out the the students.
C. We buy milk and gasoline in liters, but pharmacists who use smaller units will dispense items in milliliters. A milliliter is about the size of a square of sugar. The average housewife will become very familiar with this phase of metrics as much as she will buy in the supermarket, retail department store, etc., because items will be marked in these terms.	

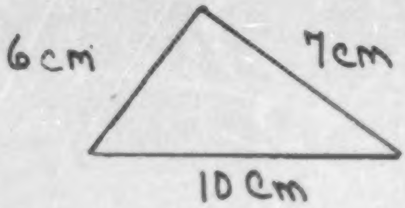
Topical Outline	Suggestions for Instructors
Answer to Handout IV-6 1. 1000 5. 3000 2. 1000 6. 3 3. 1 7. 12 4. 3000 8. 12	Pass out Handout IV-6 and have participants work the problems. At this time, participants should be familiar with all phases of metrics. Ask them to bring in 3 or more examples of items being marked with metric measurement. Suggest clothing, boxes, food signs, temperature, etc. for discussion at the next session.
IV. REVIEW OF THE SESSION	Ask for questions, mention to participants that the next session will cover mass. Also, it will be the final session. Thank them.

Handout IV-1

REVIEW FOR AREA

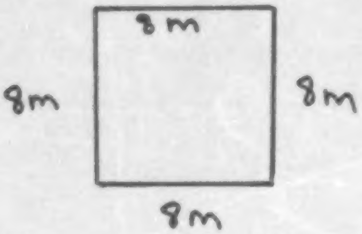
Find the perimeter of each figure.

1.


6cm
7cm
10 Cm

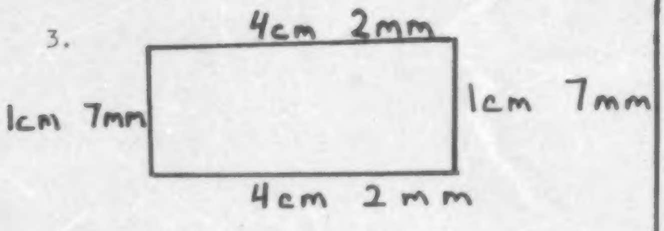
Perimeter: _____ cm

2.



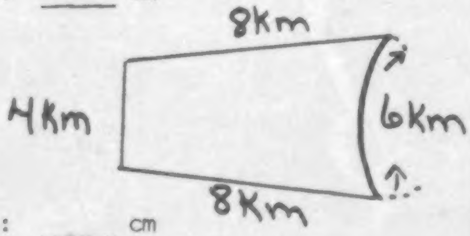
Perimeter: _____ cm

3.


4cm 2mm
1cm 7mm
1cm 7mm
4cm 2 mm

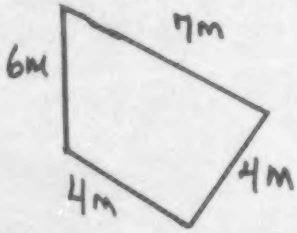
Perimeter: _____ cm

4.


8Km
4Km
6Km
8Km

Perimeter: _____ cm

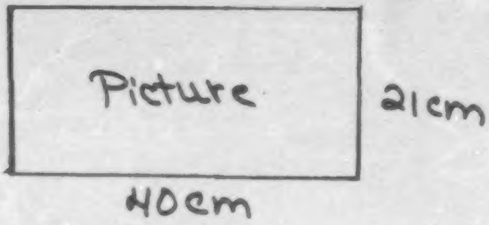
5.



Perimeter: _____ cm

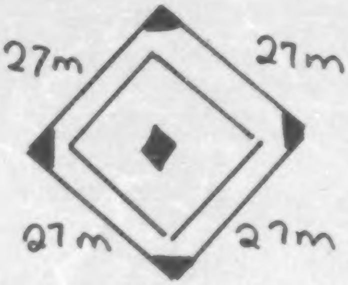
Find the area of each figure.

6.


Picture
21cm
40cm

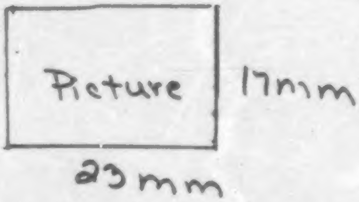
Area: _____ sq cm

7.


27m
27m
27m
27m

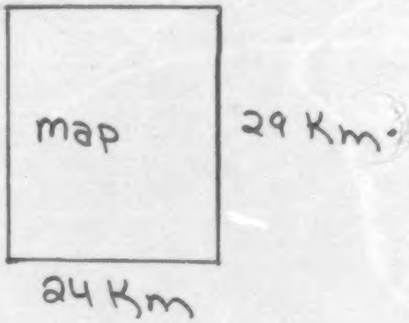
8.

Area: _____ sq cm


Picture
17mm
23mm

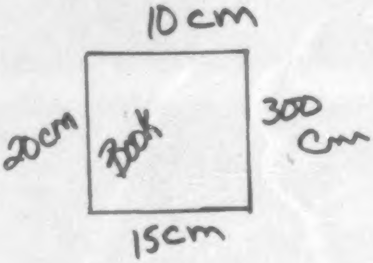
Area: _____ sq cm

9.


map
29 Km.
24 Km

Area: _____ sq cm

10.


10cm
20cm
Book
300 cm
15cm

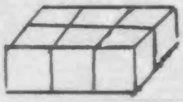
Area: _____ sq cm

Handout IV-2

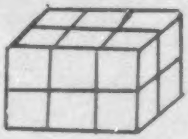
VOLUME AND CAPACITY

Each block is shaped like a cube. Each block shows a cubic unit.

1. How many cubic units are needed to build this figure? _____

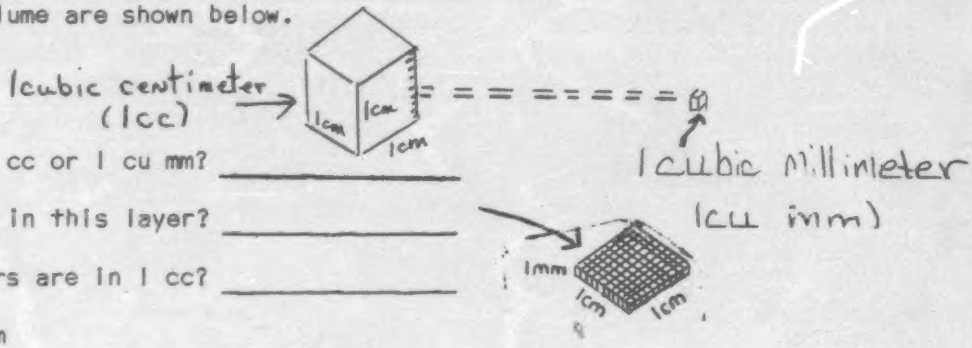


2. How many cubic units are needed for this figure? _____
3. What is the volume of this figure? ____ cubic units



- -

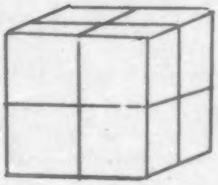
Two metric units of volume are shown below.



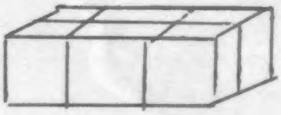
4. Which is larger, 1 cc or 1 cu mm? ____________
5. How many cu mm are in this layer? ____________
6. How many such layers are in 1 cc? ____________
7. 1 cc = _____ cu mm

- -

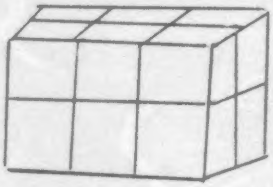
Find the volume of each figure below.



8.



9.



10.

_____ cc

_____ cc

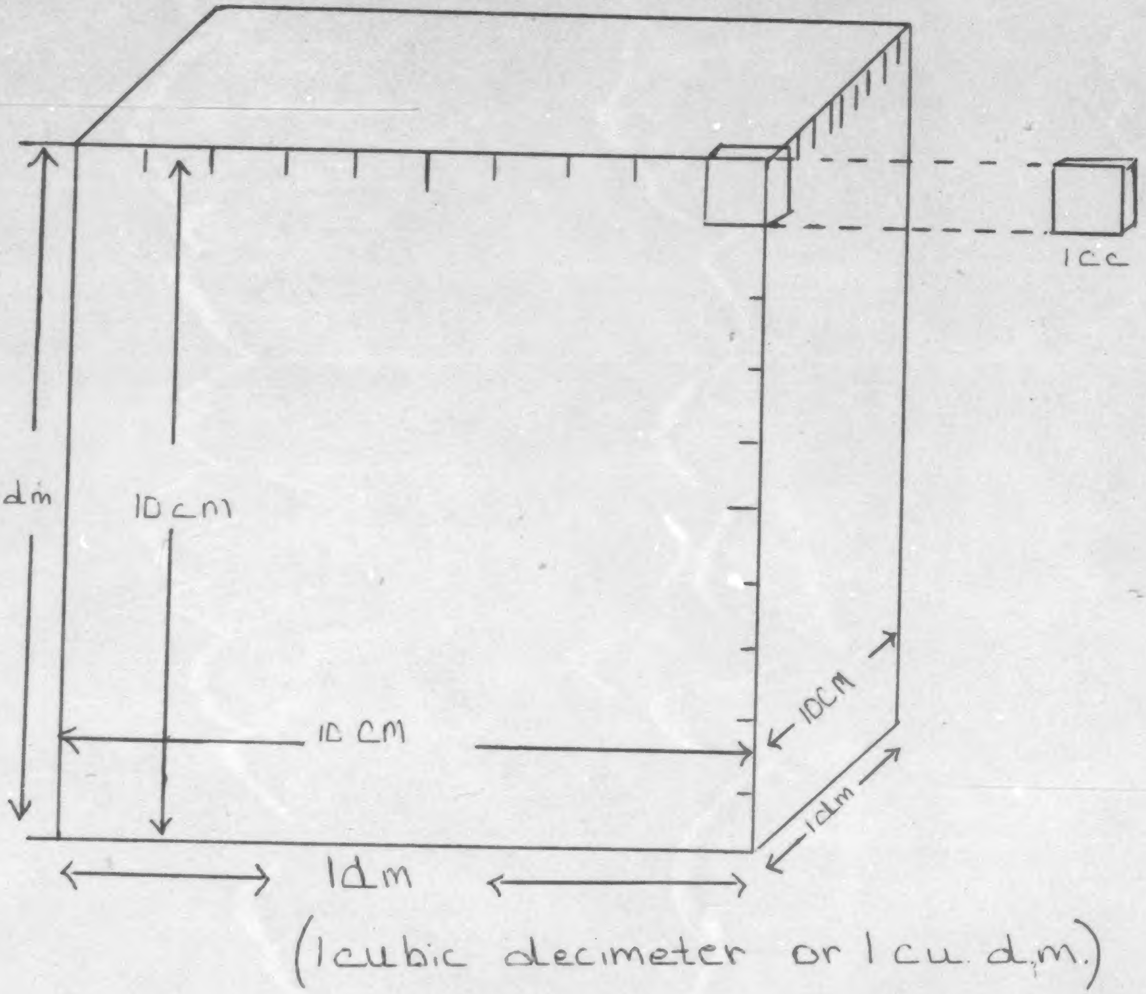
_____ cc

NOTE: The common abbreviation for cubic measurement is cu, such as cubic millimeters (cu mm) or cubic decimeters (cu dm). However, the exception is the abbreviation for cubic centimeters which drops the second letters and becomes only cc.

Handout IV-3

LARGER UNITS OF VOLUME

To find the volume of a suitcase or your classroom, larger units of volume are convenient. The actual size of one such unit is shown below.


1 cc
1 dm
10 cm
10 CM
10 CM
1 dm
1 dm
(1 cubic decimeter or 1 cu. d.m.)

1. Each edge of a cubic decimeter is _____ cm long.

2. 1 cu dm = _____ cc

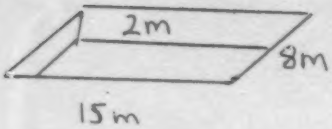
You can write 1 cubic meter as 1 cu m.

3. Each edge of a cubic meter is _____ m long.

4. Each edge of a cubic meter is _____ dm long.

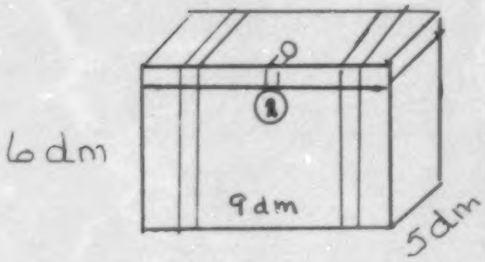
5. 1 cu m = _____ cu dm

Handout IV-3
(cont.)



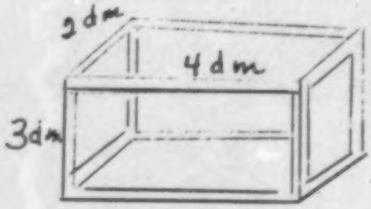
6. An excavation for a basement has the dimensions given. How many cubic meters of earth were removed?

_____ cu m



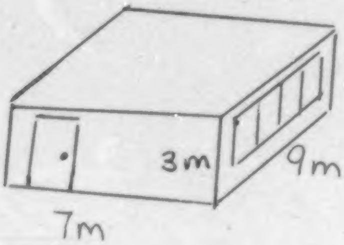
7. Bob measured the edges of an antique trunk. The measurements are given. What is the volume of the trunk?

_____ cu dm



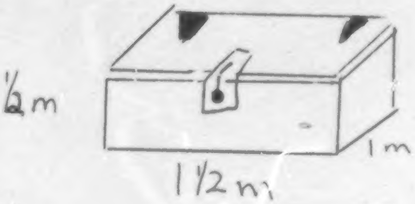
8. Tonya gave the dimensions of an aquarium in decimeters as shown. Find the volume of the aquarium in cubic decimeters. _____ cu dm

in cubic centimeters _____ cc



9. The dimensions of a classroom are given. Find the volume of the room.

_____ cu m



10. Todd gave the lengths of the edges of a storage box as shown. Find the volume of the box in cubic decimeters.

_____ cu dm

[1 m = 10 dm, so 1/2 m = (1/2 x 10) dm.]

Handout IV-4

CAPACITY

The amount a container will hold is called its capacity.
Capacity can be given in units of liquid measure or in cubic units.

Follow the directions on the next page. Then answer the following.

1. Which is larger, 1 quart of 1 liter? ______________________________

2. Could you put 1 quart of milk in a liter bottle? ____________________

3. Could you put 1 liter of milk in a quart bottle? ____________________

4. Could you put 4 liters of milk in a gallon bottle? __________________
How do you know?

Complete the table below.

5.	kilo means 1000	1 kiloliter (kl) = ________________ liters
6.	hecto means 100	1 hectoliter (hl) = ________________ liters
7.	deka means 10	1 decaliter (dal) = ________________ liters
8.	deci means 1/10	1 deciliter (dl) = ________________ liters
9.	centi means 1/100	1 centiliter (cl) = ________________ liters
10.	milli means 1/1000	1 milliliter (ml) = ________________ liters

Handout IV-4
(cont.)

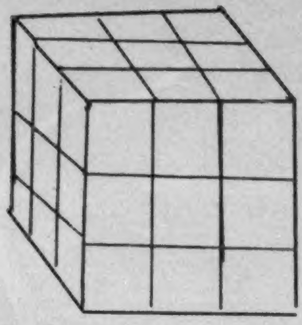
Cut along the 2 black lines on this page.

Then roll into a cylinder and tape.

Filled to here is 1 liter

Filled to here is 1 quart

Handout IV-5



VOLUME AND AREA

Ralph stacked wooden centimeter cubes to build the figure shown to the right.

1. How many cubes did he need? ______

He plans to paint the outside of the figure, including the top and bottom.

2. What will be the area of the painted surface? ______ sq cm

3. How many cubes will have only 3 faces painted? ________

4. How many cubes will have only 2 faces painted? ________

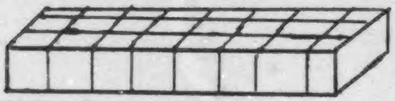
5. How many cubes will have only 1 face painted? ________

6. How many cubes will have no faces painted? ____________

- -

Get yourself 24 cubes (sugar cubes, dice, or wooden blocks). You can stack them in 6 different ways to build a figure shaped like a box. One of these figures is shown below. Build the others.

TOP: 24 sq. units



END:
3 sq. units

FRONT: 8 sq. units

AREA:

top and bottom:	(2x24)	48 sq. units
both ends:	(2x3)	6 sq. units
front and back	(2x8)	16 sq. units
TOTAL AREA:		70 sq. units

Find the volume and the area of each figure.

7. If 2 figures have the same volume, do they have the same area? ____________

8. What are the dimensions of the figure with the least area? ______________

9. What are the dimensions of the figure with the largest area? ____________

10. At this time, do you think metrics are easier or harder than our past system? Why?

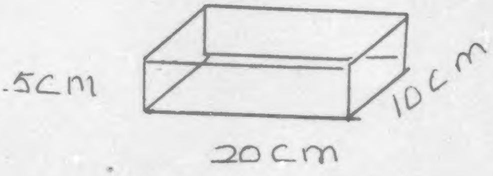
Handout IV-6

CAPACITY AND VOLUME

You learned that I liter and I cubic decimeter are two names for the same volume.

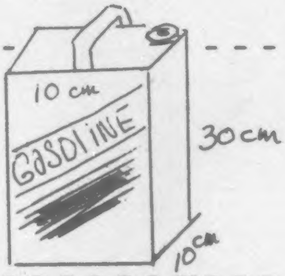
A plastic tray has the dimensions given below.

1. The volume of the tray is _____ cc.
2. Since I cc = I ml, the capacity of the tray is _____ ml.
3. Since 1000 ml = I liter, the capacity can also be given as ______ liter.



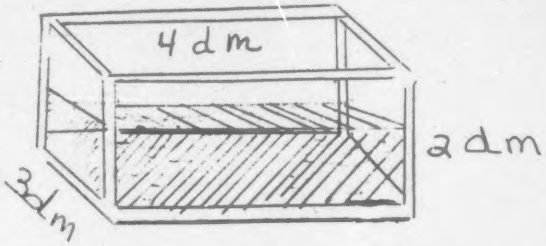
- -

4. The volume of this can is _______ cc.
5. Its capacity is ________ ml.
6. Its capacity can also be given as _____ liters.



- -

An aquarium has the dimensions given below. It is half filled with water.

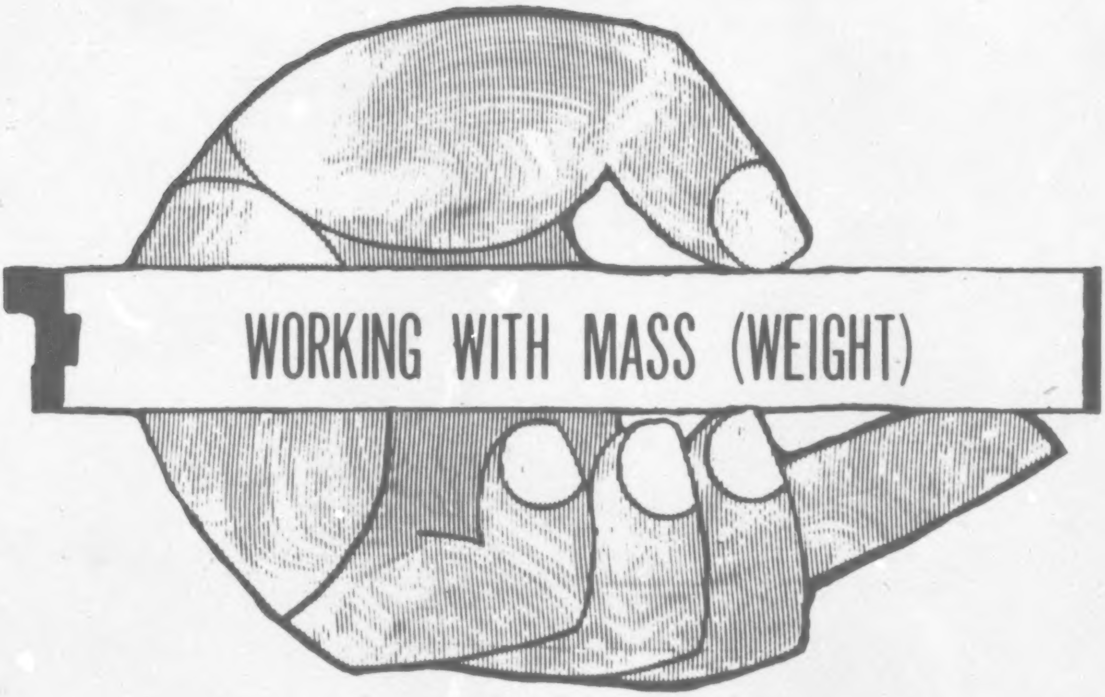


The amount of water in the aquarium can be given in these two ways.

7. _________ cu dm

8. _________ liters

SESSION V:



WORKING WITH MASS (WEIGHT)

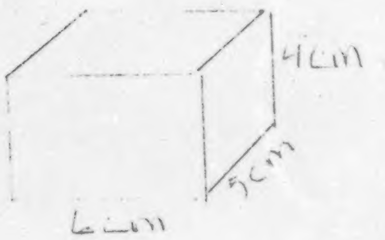
Topical Outline	Suggestions for Instructor
I. REVIEW	Review last session. Use Handout V-I as a quiz or summary.
Answer to Handout V-I 1. 120 6. 3 2. 540 7. 7 3. 1 8. 1000 4. 12 9. 4000 5. 9 10. 5	List on chalkboard. Show and discuss items of merchandise marked with the metric system. Point out some of the problems business people will have if they cannot think in metric terms.
II. METRIC MASS	
1 metric ton (t.) = 1000 kilograms (kg.) 1 kilogram (kg.) = 1000 grams 1 hectogram (hg.) = 100 grams 1 decagram (dkg.) = 10 grams 1 gram (g) = 1 gram 1 decigram (dg.) = 1/10 gram 1 centigram (cg.) = 1/100 gram 1 milligram (mg.) = 1/1000 gram	List on chalkboard.
Gram is the basic unit of weight	
Make these number sentences true:	Have these on flip chart before class starts. Work out with participants.
1. 1 dkg. = 10 grams 20 grams = 2 dkg. 30 grams = 3 dkg.	
2. 100 grams = 1 hg. 200 grams = 2 hg. 300 grams = 3 hg.	
3. 1000 grams = 1 kg. 2000 grams = 2 kg. 3000 grams = 3 kg.	
4. 1000 kg. = 1 t. 2000 kg. = 2 t. 3000 kg. = 3 t.	
5. 1 dg. = 1/10 gram 2 dg. = 2/10 or 1/5 gram 3 dg. = 3/10 gram	
6. 1 cg. = 1/100 gram 2 cg. = 2/100 or 1/50 gram 3 cg. = 3/100 gram	
7. 1 mg. = 1/1000 gram 2 mg. = 2/1000 or 1/500 gram 3 mg. = 3/1000 gram	

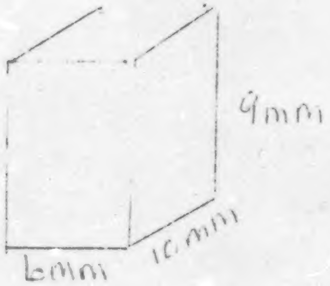
Topical Outline	Suggestions for Instructor
Handout V-2 1. 1000 2. 1000 3. 200 4. No 5. 1000 6. 1 7. 13 8. 22 9. 55 10. Todd, 1 kilogram is more than 1 pound.	Handouts will be given out to the students for them to work out with the instructor.
Handout V-3 1. 1 g 2. 1 g 3. 1 kg 4. 10 g 5. 2 kg 6. 10 kg 7. 1 kg 8. 80 kg 9. Tonya 10. 45	
Handout V-4 1. 1 2. 1000 3. 1000 4. 1 5. 1000 6. 22 7. 16 8. less; 97 9. 45 10. less	
Handout V-5 1. 1000 2. 4000 3. 1000 4. 7000 5. 1000 6. 3000 7. 200 8. 200 9. 200 10. 5 11. 1000; 1 12. 50 1/2 13. 80;140 14. 600 15. 1 16. 1 17. 1 18. 3000 19. 2 20. 5000	After the class finishes this exercise, review the total metric unit that has been covered in this program. Make sure everyone has a thorough understanding that metrics can be beneficial to them in everyday life if they understand how it works. Don't explain it by converting. When one wants to figure out something larger, multiply, or something smaller, divide. It's just a matter of working with the multiples of 10. Thank them.

Handout V-1

REVIEW FOR VOLUME

Find the volume of each figure.




9mm
10mm
6mm

1. ______________ cc

2. ______________ cu mm

Complete the following.

3. 1 cc = ________ ml

4. 12 cc = ________ ml

5. 9 ml = ________ cc

6. 3 cu dm = ________ liters

7. 7 liters = ________ cu dm

8. 1 liter = ________ ml

9. 4 liters = ________ ml

10. 5000 ml = ________ liters

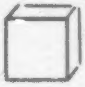
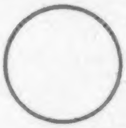
Handout V-2

WEIGHT

In the metric system, weight is measured in grams.
Smaller objects can be weighed in milligrams (mg).
Heavier objects can be weighed in kilograms (kg).

1. Since milli means 1/1000, 1 g = ____________ mg.

2. Since kilo means 1000, 1 kg = ____________ g.

1cc of water  weighs 1 gram	1 teaspoonful of water weighs about 5 grams
1 nickel  weighs about 5 grams	1 pound of butter weighs about 454 grams

3. How many nickels would it take to weigh 1 kilogram? ____________________

4. Are two pounds as much as 1 kilogram ? ____________________

5. One liter of water is ____________ cc of water.

6. One liter of water weighs ________________ kilogram.

Complete the following.

7. 6 kg __________ pounds

8. 10 kg __________ pounds

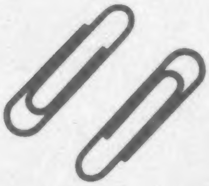
9. 25 kg __________ pounds

10. Tonya weighs 72 pounds. Todd weighs 72 kilograms. Who is heavier? __________
How do you know?

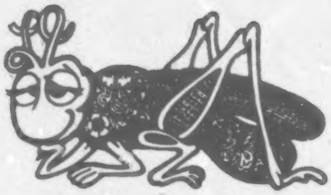
Handout V-3

PROBLEMS ABOUT WEIGHT

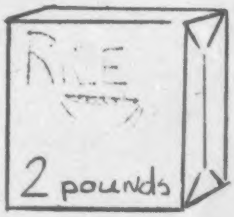
1 kg = 1000 g and 1 g = 1000 mg.
Underline what you think is the approximate weight of the objects.



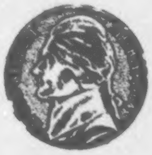
1. 1 mg 1 g 1 kg



2. 1 mg 1 g 1 kg

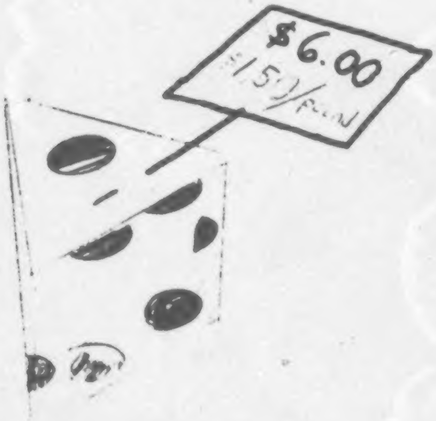

RICE
2 pounds

3. 1 mg 1 g 1 kg

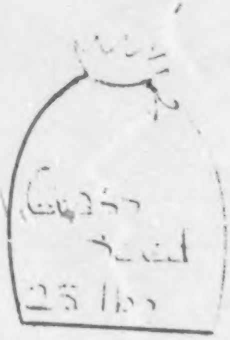


4. 10 mg 10 g 10 kg

1 kilogram is a little more than 2 pounds.
Underline what you think is the approximate weight of each object.

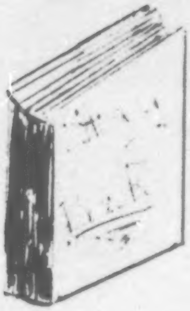

$6.00
$1.50/pound

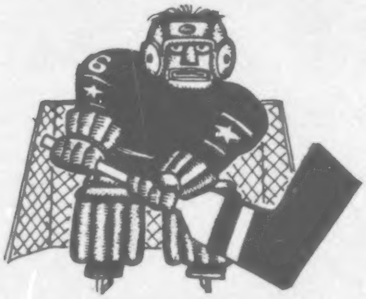
5. 1 kg 2 kg 20 kg


Grass
Seed
25 lbs

6. 1 kg 10 kg 100 kg

Handout V-3 continued





7. 8 kg 80 kg 800 kg

8. 1 kg 10 kg 100 kg

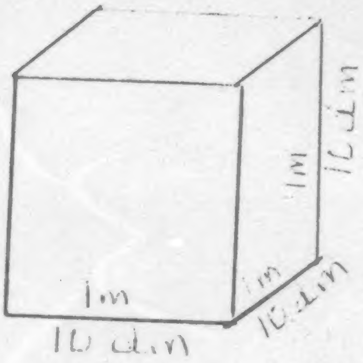
9. Tonya weighs 72 pounds. Todd weighs 30 kilograms.

Who is heavier? ____________

10. A bottle of eyewash contains 18 cc of liquid and weighs 15 grams. What is the weight of 3 bottles of this eyewash?

________________ g

Handout V-4



METRIC TON

1. The volume of the tank is ____ cu m.

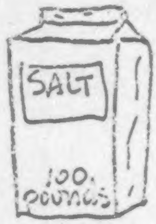
2. The volume can also be given as ____ cu dm.

Suppose you filled the tank with water.

3. Since 1 cu dm = 1 liter, it can hold ________ liters of water.

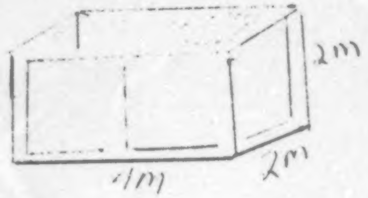
4. 1000 liters = ________ kl.

5. Since 1 liter of water weighs 1 kilogram, the water in the tank would weigh ________________ kilograms.



Another name for 1000 kilograms is 1 metric ton (t)

6. A bag of salt pellets is shown at the right. How many of these bags would it take to make approximately 1 metric ton?



7. A storage tank has the dimensions shown. It is completely filled with water. What is the weight of the water?

8. The weight of each player on a football team is given below:

Max:	72 kg	Tony	87 kg	Gene	75 kg	John	82 kg
Don	78 kg	Bill	93 kg	Randy	96 kg	Ken	80 kg
Jeff	86 kg	Rex	70 kg	Jose	84 kg		

Is their combined weight more or less than 1 metric ton? ______________
by how many kilograms? ________________

9. A turbojet traveled about 1 kilometer on 15 kilograms of fuel. About how many metric tons of fuel were needed to travel 3000 kilometers? ________

10. There were 30 students in one class. Their average weight was 73 pounds. Was their combined weight more or less than 1 metric ton? ___________

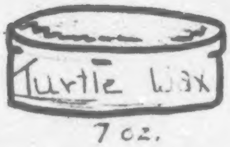
Handout V-5

REVIEW OF MASS

Complete the following.

1. 1 g = __________ mg
2. 4 g = __________ mg
3. 1 kg = __________ g
4. 7 kg = __________ g
5. 1 t = __________ kg
6. 3 t = __________ kg

A can has the dimensions shown.



7. What is the volume of the can? ____ cc
8. How many milliliters of water can it hold? ____ ml
9. What would that much water weigh? ____ g
10. How many cans of water are needed to make 1 liter? _____
11. How much would the 1 liter of water weigh? ____ g or ____ kg

12. A small, single-engine airplane weighs 1 1/2 metric tons. A jet airliner weighs 52 metric tons. How much heavier is the jet airliner? ______________ t

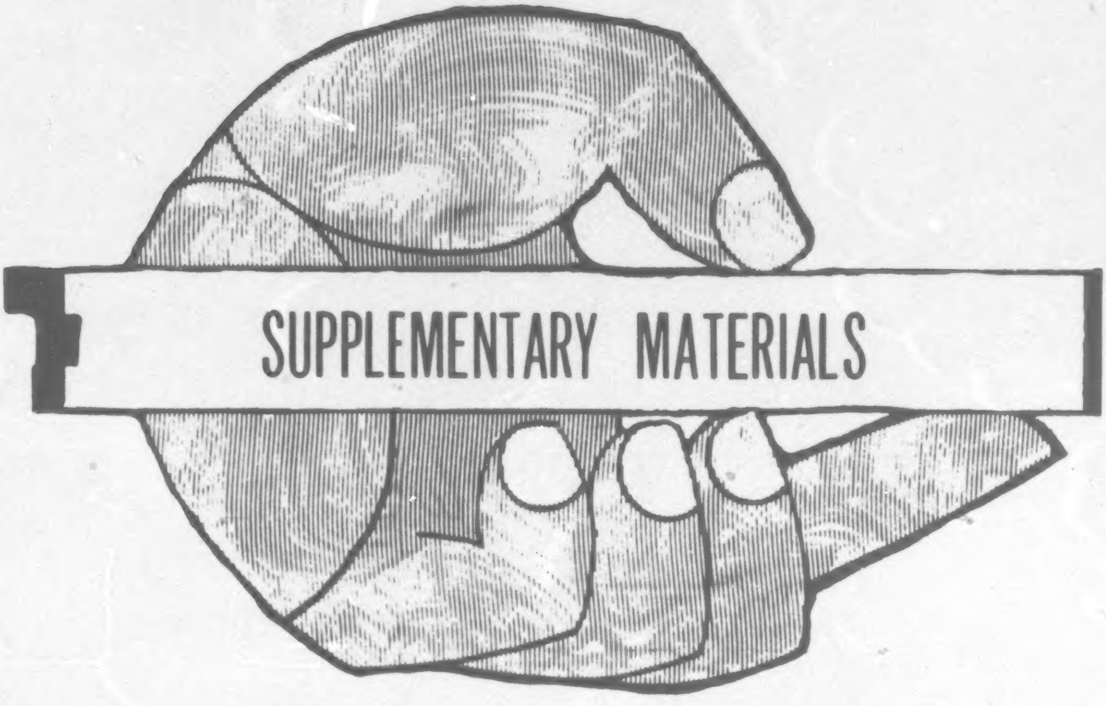
13. An experiment requires 4 grams of sulphur and 7 grams of iron. The teacher asked each of the 20 students in class to do the experiment.

How many grams of sulphur are needed? ____ g
How many grams of iron are needed? ____ g

14. A doctor prescribed some pills. Each pill contains 5 milligrams of a drug. How many of these pills can be made from 3 grams of the drug? ______________

Complete the following.

15. 1000 mg = ________________ g
16. 1000 g = ________________ kg
17. 1000 kg = ________________ t
18. 3 g = ________________ mg
19. 2000 g = ________________ kg
20. 5 t = ________________ kg

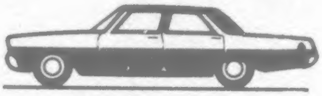


SUPPLEMENTARY MATERIALS

LENGTH

Basic unit is the meter (m)

1 meter = approximately 1.1 yards

COMMON MULTIPLES	COMMON USAGE
1 kilometer (km) = 1000 meters approximately .6 mile	Distances Speed Limits
1 centimeter (cm) = 0.01 meter approximately .4 inches	30 cm Ruler Clothing Sizes
1 millimeter (mm) = 0.001 meter approximately .04 inches	 Engineering Design
1 micrometer (um) = 0.000 001 meter approximately .000 04 inches	 Surface Finish

MASS

Basic unit is the kilogram (kg)

1 kilogram = approximately 2.2 pounds

COMMON MULTIPLES COMMON USAGE

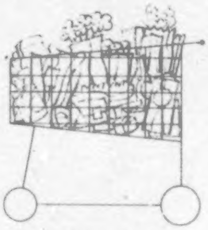
1 metric ton (t) = 1 000 kilograms

approximately 2,200 pounds

Shipping

1 gram (g) = 0.001 kilogram

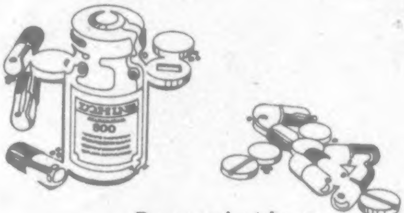
approximately 0.035 ounce



Consumer Labeling

1 milligram (mg) = 0.001 gram

approximately 0.015 grain



Prescriptions

COMMONLY USED METRIC TERMS

METER → kilometer
METER → centimeter
METER → millimeter

LITER → milliliter

GRAM → kilogram
GRAM → milligram

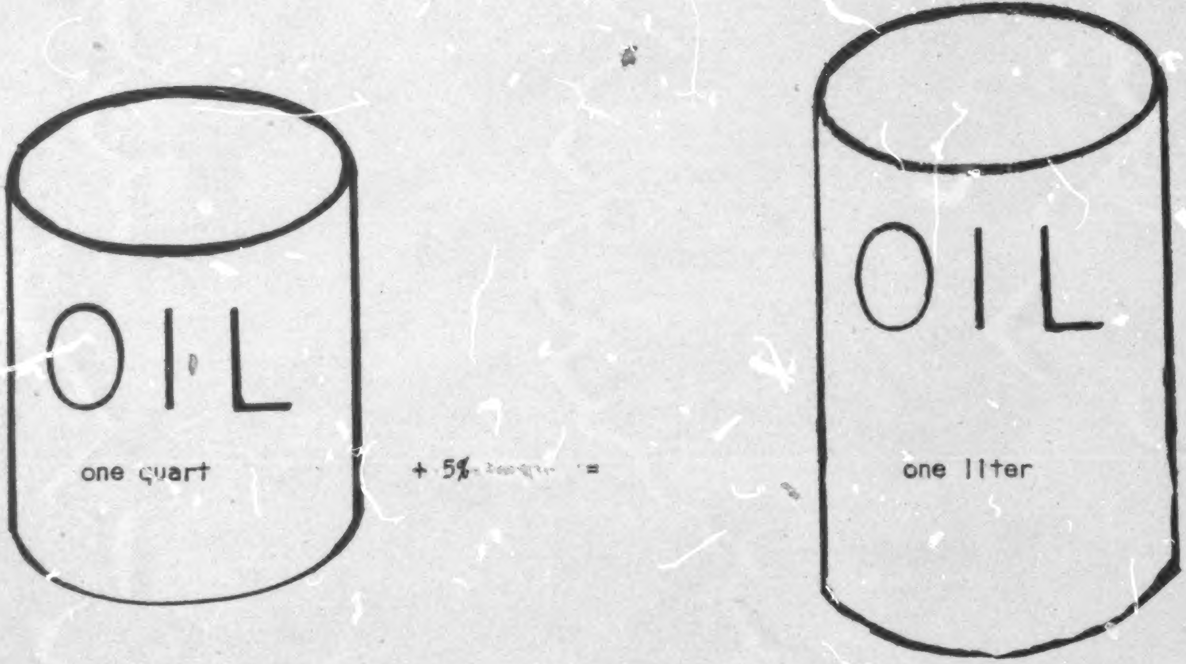
VOLUME

Basic unit is the liter

1 liter = approximately 1 quart plus 5%

COMMON MULTIPLE

milliliter = 0.001 liter


OIL
one quart
+ 5% =
OIL
one liter

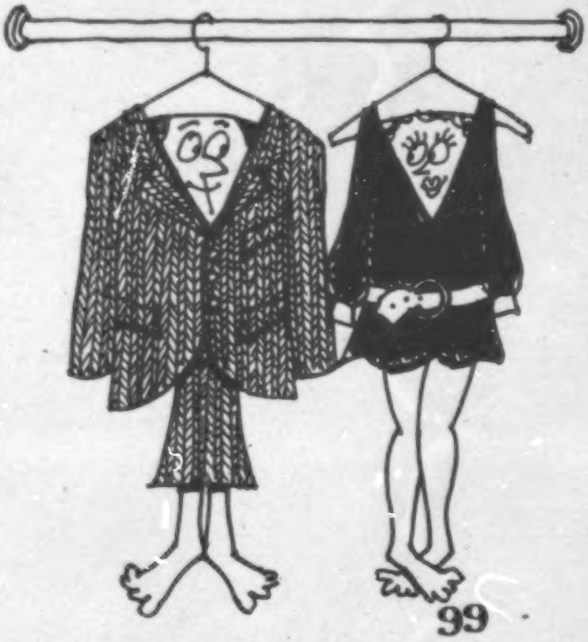
CLOTHING SIZES

WOMEN

U.S. Size		Metric Size
21	Hats	53
22		56
23		58
24		61
24 1/2		62
10	Dresses	38
12		40
14		42
16		44
18		46
20		48
8	Stockings	0
9		2
10		4
11		6
4	Shoes	34
5		35
6		36
7		38
8		38.5
9		40
10		41

MEN

U.S. Size		Metric Size
6 1/2	Hats	52
6 3/4		54
7		56
7 1/4		58
7 1/2		60
13	Shirts	33
14		35
15		37
16		40
17		42
9	Socks	23
10		25.5
11		28
11 1/2		29.25
12		30.5
6	Shoes	38
7		40
8		41
9		43
10		44
11		45
12		46



TEMPERATURE

Base unit is the kelvin (K)

	FAHRENHEIT SCALE °F	CELSIUS SCALE °C
Body Temperature	98.6°F	37°C
Comfortable Room Temperature	68 °F	20°C
Boiling Point of Water	212 °F	100°C
Freezing Point of Water	32 °F	0°C

THE METRIC VERSUS THE UPPER VOLTA SYSTEM*

Sen. Clairborne Pell (D, R.I.) introduced in 1968 the Metric Study Act, the Metric Conversion Act of 1971 - which was passed by the Senate in August 1972, and S.100 in January 1973. He is also probably the first to rename the English or inch system as the Upper Volta system to reflect the geographical area of many inch countries.

Senator Pell cites three benefits from metrication: "First, the ability to produce one line of products that will be equally acceptable for internal and external markets; second, the efficiency possible with its use; and third, the common language advantages it will give us in standards-making with the rest of the world."

He is concerned about the costs for small business and his bill includes help-for-small-business provisions that were knocked out of the original bill passed last August. The senator also has a rule of thumb on costs: "A firm's cost of metrication is a fairly good indication as to how well the switch is being handled. High costs mean it is not being handled correctly."

Congress, however, is after the fact in many ways. Metric measurement was legalized in the U.S. in 1866. Metric weights were established for U.S. coinage in 1876, and the yard and the pound were defined in terms of the meter and the kilogram in 1893.

And today, electric energy and illumination are legally defined in metric units. Science and research, especially in aerospace, nuclear physics, and theoretical chemistry, deal in metric measures. Some Army ordinance and Army maps are metric. The optical, ball bearing, and photographic industries are largely metric. And the medical and pharmaceutical professions are entirely metric. Nearly 30% of all automobiles sold this year will have major metric components. Sparkplugs are metric and most of Chrysler Corp.'s 1974 blueprints are in metric or are dual-dimensioned.

* Source: Industry Week

This year, the U.S. can end its aimless drift to the metric system.

Bills for national metric conversion have been introduced in both houses of Congress. The House bill introduced by Rep. Olin E. Teague (D, Texas) is essentially the Senate-passed bill of last August. Legislation in the Senate, again introduced by Sen. Clairborne Pell (D, R.I.) differs slightly from the bill passed last year. The Pell Bill includes 5 basic points:

* Conversion to the metric system within 10 years.

* Creation of a national Metric Conversion Board to plan and implement metric conversion.

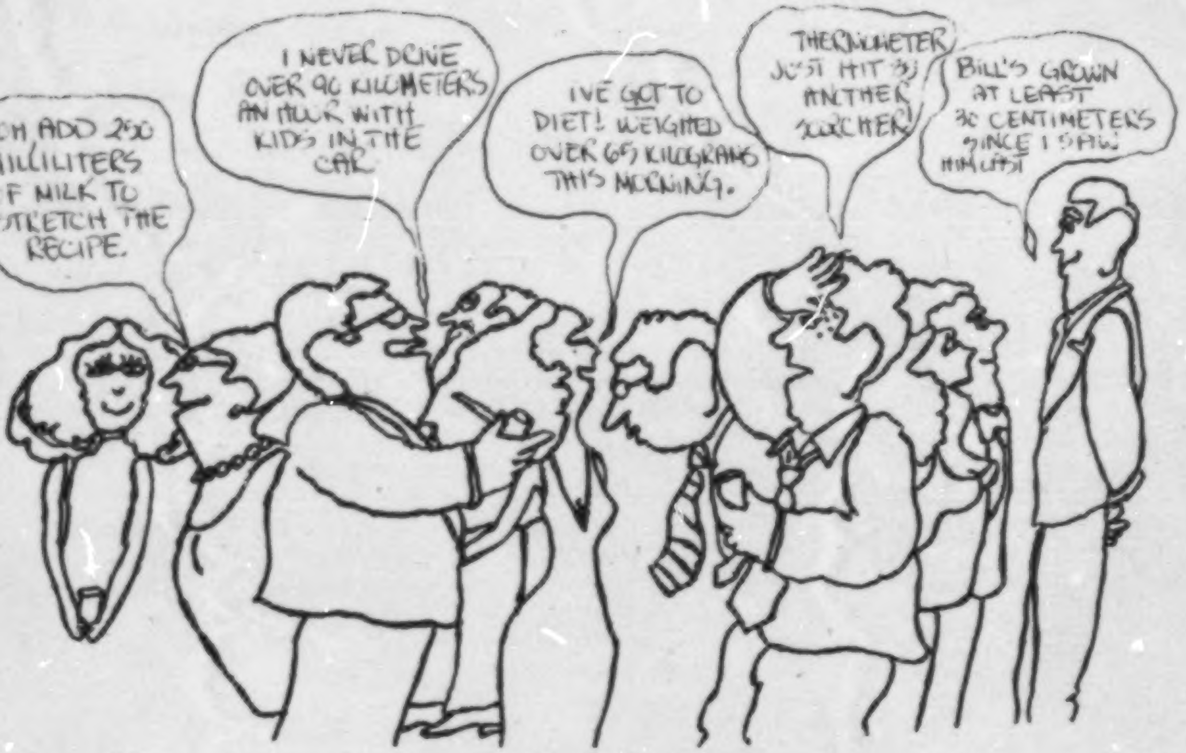
* A requirement that the conversion plan include provisions for an appropriate appeals process to grant exemptions from the use of metric units and standards in cases of unforeseen hardship.

* Provision for financial.assistance to small businesses and individuals severely affected by metric conversion.

* Establishment of a national information program about metric conversion.

Instead of maintaining a dual system of weights and measures as provided in last year's Administration bill, Sen. Pell's bill would make metric units the only legal system of measurement unless an exemption is provided either in the metric conversion plan to be presented to Congress by the Metric Conversion Board or by the appeals commission established by the act.

PELL - Metrication means "the ability to produce one line of goods that will be equally acceptable for internal and external markets."


OH, ADD 250 MILLILITERS OF MILK TO STRETCH THE RECIPE.
I NEVER DRIVE OVER 90 KILOMETERS AN HOUR WITH KIDS IN THE CAR
I'VE GOT TO DIET! WEIGHED OVER 65 KILOGRAMS THIS MORNING.
THERMOMETER JUST HIT 35; ANOTHER SCORCHER!
BILL'S GROWN AT LEAST 30 CENTIMETERS SINCE I SAW HIM LAST

THE METRICS ARE COMING !
THE METRICS ARE COMING !

Almost every country in the world either uses the metric system of measurement or is in the process of changing to it through an orderly plan. Almost every country that is, with one major exception: The United States of America.

In one way or another, though, it's coming here, too. You don't have to look hard or far to find examples:

* On your shelves, you'll find many items marked both in ounces and pounds and in grams - Nabisco crackers, Campbell soups, General Mills cereals and cake mixes, canned goods from Libby and Del Monte.

* Own a bike? Then chances are that at least some of the components were made overseas to metric measures even if the bike comes from an American firm, such as Schwinn. Because some parts are metrc-based and some U.S., you need 2 sets of tools for repairs.

* Most foreign-made cars are built on metric, of course, but several American-made autos also contain metric components. Ford is already building metric engines for its Pinto and Mustang II.

* The state of Ohio has begun erecting road signs showing distances in both miles and kilometers. Several other states have at least a few similar signs.

* The U.S. pharmaceutical industry made the changeover more than 15 years ago with little fuss, and metric measures are standard in science and medicine.

* People who make their own clothes know that patterns and fabric yardage charts

are marked in meters and centimeters as well as yards and inches.

* Public schools in California and Maryland are committed to begin converting to the metric system soon. By 1976, California expects that all math and science textbooks will contain nothing but metric terms.

Thus, there's plenty of evidence of the metric system's arrival here. But the coming hasn't been orderly. It has been haphazard and that complicates the problem of getting used to it.

There has surely been plenty of time to get ready. In the U.S. the system has been debated since 1821, when the first governmental studies were made. In recent years Congress has considered numerous bills calling for a planned move to metric. In 1972, the Senate actually passed a bill sponsored by Sen. Claiborne Pell of Rhode Island, but the House failed to act.

One of the big controversies is over who will pay the costs of conversion - whether the costs will lie where they fall or whether there will be federal government assistance to individuals (such as mechanics who must buy their own tools) and companies affected by the change.

The fact is, no one knows exactly what conversion will cost. Some estimate it at 100 billion dollars spread over 30 years. Others see savings that will offset any expense.

Proponents of metrication argue, for example, that American-made goods will be more acceptable overseas if they are built on the metric system.

IT'S SIMPLE TO USE !

Whether Congress acts or not, you're going to see more of the metric system in the future. The system is easy, but it's different. The words it uses sound funny to ears grown used to ounce, quart, Fahrenheit and foot.

Our present system, inherited from Britain (which is changing to metrics according to plan) is a medieval hodgepodge. It's hard to realize how cumbersome and complicated it really is if you've used it all your life.

For instance, you can measure length by inches, feet, yards or miles, but there is no uniform relation between them: an inch is 1/2 of a foot, a foot is 1/3 of a yard and so on. An ounce can mean either volume (an ounce of milk) or weight (an ounce of cheese). A dry quart is about 16% larger by volume than a liquid quart.

The metric system, by contrast, is simple and unified. It is a decimal system based on a unit of 10, just like our currency where 10 pennies equal a dime and 10 dimes equal a dollar.

Each physical quality, such as length, weight, volume and temperature, has its own unit of measurement in metrics. Meter, gram, liter and Celsius (the term now used instead of centigrade) degree are the basic units, and standard prefixes are used for decimal fractions and multiples of these basic units, though they aren't commonly used for temperature. So there are 1,000 millimeters or 100 centimeters in a meter, and a kilometer is 1,000 meters. The same prefixes and relationships are used for grams and liters.

As an easy reference to our present system you can remember that there are 30 centimeters to a foot and a meter is a bit longer than a yard; a liter is a bit more than a quart; 6 grams is about the weight of a nickel and 30 grams is a bit more than one ounce; water freezes at 0° Celsius and boils at 100° Celsius.

USING IT EVERY DAY.

Whether we are aware of it or not, most of us have developed a feel for our present measurements. We can visualize a 9-by-12-foot carpet. We know that a pound of meat is a hearty serving, that half a pint of milk will quench our thirst. We are used to measuring things against our own height and weight in feet and pounds.

No one can say precisely what will happen to product sizes after the U.S. officially goes on the metric system, but there are likely to be some changes. For instance, milk cartons could grow to 1 liter to replace the quart, 4 liters to replace the gallon. You might buy butter in a 500-gram (slightly more than a pound) package, with 4 sticks of 125 grams each. Instead of a 9-by-12 (foot) carpet you might buy a 3-by-4 meter one, and when you need to tighten a bolt, you probably will reach for a 6-millimeter wrench instead of your old quarter-inch tool.

You'll learn through experience that a kilogram of T-bone steak is plenty to feed 2 (slightly more than 2 pounds), that it is hot out when the temperature is 30° Celsius.

In the kitchen, measuring cups and spoons probably will be marked with both metric scales and with the customary cups, teaspoons and tablespoons, though cookbook recipes in countries long settled into metrics, list ingredients by milliliters or grams.

For a packet of information about the metric system, including a list of companies that make metric educational materials, and a wallet-size conversion card, write to the Metric Information Office, National Bureau of Standards, Washington, D.C., 20234.

Source: Changing Times, May 1974

METRICATION AND VOCATIONAL DISTRIBUTIVE EDUCATION

Excerpts from a paper presented by Dr. Neal E. Vivian, Associate Professor of Distributive Education of The Ohio State University at the National Education Conference of the United States Metric Study, Washington, D.C.

Generally, high school students do not enter the distributive education until their sophomore or junior year. Measurement units are used in the sophomore, junior and senior years in high school, throughout post-secondary programs and in certain adult classes.

Included in measurement units in the distributive education program are problems in linear measure, square measure (area), cubic measure (volume), dry measure, liquid measure, avoirdupois measure, time and distance.

Problems involving these measuring units are found in virtually every type of distributive occupation.

Examples of activities involving these measures are:

Linear - Dry goods, Lumber
Area - Carpeting, Lawn and Garden Supplies
Volume - Lawn and Garden Supplies, Construction Dealer
Dry Measure - Produce Markets, Grocery
Liquid Measure - Drugstore, Beverage Store, Gasoline Station
Avoirdupois - Hardware, Grocery Store
Time - Parking Lot, Tool Rental Agency
Distance - Car Rental Agency
Counting - Office Supply Store

A careful examination of texts, study guides, course descriptions and other material relevant to the distributive education program failed to uncover any reference to the metric system whatsoever. Even special courses in trade contained no references to the metric system. Apparently only one system of measurement is taught and used in distributive education class rooms.

Considerable time in the distributive education program, particularly on the high school level, is devoted to measures. An examination of textbooks, study guides, and suggested courses of study indicates that the problems are grouped on the following levels:

1. Problems involving counting and measuring terms such as dozen, gross, quire and score.
2. Converting units into their various multiples and sub-multiples e.g. as feet into inches, ounces into pounds, ounces into gallons or vice versa.
3. Performing the basic arithmetical operations on standard measureing units as in adding, subtracting, multiplying or dividing yards, feet and inches or pounds.
4. Multiple process problems such as determining the total amount of a transaction based upon a unit measurement price.

Examples of problems in each of the above categories or levels are shown below.

1. Counting or measuring terms:

   An office supply store wishes to replenish its stock of No. 2 lead pencils. It has only 75 such pencils on hand. How many gross must it order to bring the inventory up to 500 ?
2. Conversion of units into multiples or sub-multiples:

   How many pecks of apples in 480 bushels?
3. Basic arithmetic operations:

   The dimensions of two bedrooms are as follows: 10 feet 9 inches by 12 feet 7 inches and 11 feet 10 inches by 14 feet 8 inches. How much floor molding will he need for both rooms?
4. Multiple process problems:

   What will be the cost of paint to cover the walls and ceiling of a room with the following dimensions?

   15 feet by 18 feet with 2 doors each 30 inches wide and 7 feet high. There is also a picture window 100 inches wide and 40 inches high. This particular paint is guaranteed to cover 400

square feet with one coat. Its retail price is $7.95 per gallon and $2.65 per quart.

The above problems reflect actual operations involving measurements in distributive occupations and are typical of problems in pre-employment tests used by representative national chain stores.

The problems also illustrate the rather complex processes carried in distributive occupations where measurement is involved.

Under our present system, changing square feet to square yards, square yards into acres, feet and inches into board feet or fluid ounces into gallons or barrels and ultimately, from this, calculating a price is time consuming, cumbersome, and calls for relatively complex multiplication or division.

What are the sources for complexity in our present system? First is the tendency to measure things in units unique to a particular commodity, occupation or trade, such a scale might be quite independent of any other system. Thus, lumber is measured in board feet, precious metals and jewelry by grains, pennyweights and carats, land in rods and acres, firewood in cords, produce in pecks and bushels and liquids in gills, gallons and barrels.

Second there is no consistency in the various multiples and sub-multiples of the units among the various measures. For example the units appear in multiples of 2,3,4,5-1/2,8,12,16,16-1/2, etc. ad infinitum ad absurdium [1]

The person who would become adept at working with our present system of weights and measures is forced to memorize a rather extensive table that includes units, multiples and sub-multiples that have no logical or consistent pattern.

---

[1] Burton, William K. Measuring Systems and Standard Organizations, America National Standards Institute, New York, N.Y.

Roth, in a thesis presented to a Hearing Before the Committee on Commerce of the United States Senate in 1964 described this wilderness of unrelated units follows:

> "American youngsters at an early age take quickly to our monetary system. They find that the decimal concept used in money enables them to readily grasp existing interrelations between the values of one denomination when measured against another. With understanding comes self-assurance, and the U.S. youngster is ready and anxious to engage in finance.
>
> When this same American youth is introduced to our English system of measurement, he finds himself faced with an apparent arbitrary arrangement of unrelated units such as length in miles, area in acres, and volume in gallons. Yet, a basic relationship does exist between length, area, and volume, for two lengths multiplied together give an area, and an area multiplied by a length results in a volume. This relationship, however, is hidden to view. The English system must be mastered by rote since little uniformity exists, for example, where there are 12 inches in a foot, 3 feet in a yard, 16-1/2 feet in a rod, and 320 rods in a mile. The interest and assurance displayed by our youth in monetary matters is not duplicated by contact with the English system of measurement. Our shortage of scientific and engineering manpower, it would appear, can only be aggravated rather than alleviated by this problem of comprehension."[2]

Third because the multiples are not in decimals, the addition, subtraction, multiplication and division of the various units becomes laborious and time consuming. Furthermore, the performing of the basic arithmetic functions on these units is not readily done on the typical calculating machines available in today's business establishments.

Related to this is a fourth factor--the necessity of using fractions and mixed numbers in cumbersome multiplication or division problems.

Employers complain that job seekers, whether they be recent high school graduates or adults, lack competency in working with measuring units. They also report a high rate of failure on pre-employment tests containing problems similar to those illustrated above. They further claim that they are forced to train or re-train new employees to calculate accurately where measurement units are used. They also report that repeated mistakes by incompetent employees contribute to increased expenses, a high rate of returned merchandise and customer dissatisfaction.

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[2] Roth, Norman H. "The Desirability and Practicability of Adoption of the Metric System in the United States," U.S. Congress, Senate, Committee on Commerce, Conversion to Metric System. Hearings before Committee, Eighty-eighth Congress, 2nd Session, on S 1278, January 7, 1964 (Washington: Government Printing Office, 1964). p. 32.

Without attempting to excuse the public schools and still recognizing the concern of retailers, it must be remembered that the ability to recall an extensive and illogical table of weights and measures is a very important factor here. It should also be pointed out that even when such tables are memorized they are quickly forgotten through disuse.

The basic advantage of the metric system is its simplicity which allows one to move from one unit of measurement to another by multiplying or dividing by 10. If the United States were to adopt the metric system, the arithmetic would be much simpler, since it will have in common the factor of 10 for both quantities and prices.

A conversion to the metric system would substantially reduce the amount of time spent in distributive education classes on weights and measures. Being a decimal system, the metric system is easy to learn. It would no longer be necessary for students to memorize a complicated and inconsistent table of weights and measures. Valuable class time spent on special problems of performing arithmetic functions to measuring units could be reduced, if not completely eliminated.

Less time would be spent by employers to train or retrain new employees in the applications of calculating weights and measures to their specific employment responsibility.

Undoubtedly, the British experiences in their changeover will have some definite implications for us. Lord Ritchie-Calder discussed this in a recent article.

> "Everyone warns that the trouble will come in the shops, in the bars and in the kitchen, when the public is confronted with kilograms and liters. Perhaps so, but I am optimistic. Custom has already changed drastically. Even the general storekeeper "breaks bulk" less than he once did; he does not often scoop out flour or sugar or put butter on the scales. His supplies, like those of the supermarkets, come already packaged. The success of the metric changeover in the retail trade could lie simply in packaging."[3]

Another matter related to measurements and standardization is the bewildering confusion of sizes and measurements in use for consumer goods in our country today.

Shoe sizes are based on a system that has evolved through the years and one that has no logical basis. There are different scales used for infants, children, men and women and there is no consistent relationship between them.

Stocking sizes are based on yet another system that has no relationship to shoe size. For example a person wearing a 4 shoe would wear a size 8-1/2 stocking. Gloves sizes are supposedly based upon circumference of the open hand around the knuckles but these are not standardized.

Women's clothing probably represents the epitome of confusion and inconsistency in sizes and standards. Dresses, blouses, sweaters, slips, panties and nightwear all have their own unique standards of sizes. For example the same woman might wear a size 10 dress, size 34 blouse, 38 sweater, 36 slip, size 6 panty, size 6-3/4 glove, size 8 shoe and size 10 stocking. Further confusion is added because of variation between manufacturers within each one of these items.

A similar situation occurs in the grocery field. The Almanac of the Canning, Freezing and Preserving Industries lists 30 different common can sizes. Produce such as oranges, grapefruit and melons are sized on a system based upon the number that can be packed in a standard crate. Thus a 36 size cantelope is larger than a 48 size but to the consumer reading advertisements, this could be very misleading.

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[3] (Lord) Ritchie-Calder "Conversion to the Metric System", Scientific American. Vol. 223, No. 1, July 1970, p. 25.

The hardware and building supply industry continues to cling to an archaic system of a multiplicity of unrelated and illogical measurement units.

The unit of measurement for nails is the penny, symbolized as d. Wood screws have their own numbering system, and wire a different one. However, in the case of screws, the larger the number the larger the diameter the screw, but for wire just the opposite is true. If one were to thumb through a supply catalog he would find himself in a no-man's land of sizes reported in guages, numbers, pennys, etc. Most of these units of measurement are unrelated to each other or to another common unit of measurement.

This situation has some very real implications for distributive education. Considerable time, effort and expense is involved in training salespeople to be knowledgeable regarding measurement systems and its terminology in their respective commodity groups. If we were to convert to a uniform code of commercial and industrial standards based upon a uniform and logical system, the resultant savings just in training costs alone would, in a short period of time, exceed the costs involved in such a conversion. Many other advantages would accrue to manufacturers, distributors and consumers if a logical, easily understood system of standards could be adopted.

In summary, distributive education can play an important role in an orderly changeover from the English to a metric system of measurement.

The metric system is gaining wider and wider use. It is the opinion of this writer that distributive education, in cooperation with the business community it serves, should encourage a gradual and orderly transition.

METRICS IN MARKETING

METRIC SI SYSTEM - PRESENT PROBLEMS TO FOOD RETAILING

The transition to metric in food retailing depends upon action of industries which produce, process, pack, and transport foods. There will be no one day for complete changeover.

Timetables will depend on change over of weighing equipment and prepackaged food.

WHAT WILL BE AFFECTED

1. Items that are weighed in store - examples: meat, fish, cheese, fruit, vegetables
2. Pre-packed items will not affect the retail employer a great deal. The stocking process will have to be changed in some situations.
3. Weighing equipment will need to be changed.
4. Liquid measuring equipment, where used, will need to be replaced.
5. Cost and pricing of items in metric quantities will need to be recalculated.
6. Advertisements will have to be written in metric terms.

METRICATION - HOW WILL IT AFFECT EMPLOYEE RELATIONS

1. Who will pay for new equipment that is used by employee on the job? Naturally, the company furnished all equipment. That will be no problem. But what if the employees buy their own?
2. Retraining of all employees - how will it be conducted?
3. If loss of productivity happens within your business, how will this be handled by management?
4. New work standards will have to be made up for employees. How will this affect the worker?

PROBLEMS TO LEATHERGOODS AND FOOTWEAR

1. Sizing
2. Mondopoint is the sizing system for footwear. First number in millimeters will be used in length. The average foot fitted being measured "weight on" and wearing hose.
3. Second number will be used in width and measured the same as above.
4. Body and Clothing Sizes will be measured in centimeters.

PROBLEMS IN REAL ESTATE

All land titles and surveys will remain the same until ownership changes. Then the new data will be put in metric terms.

Applicable Metric Units

As a general rule:

1. Areas of parcels less than 1 hectare (ha) or 10,000 square meters (m^2) shall be shown in square meters (m^2).

2. Areas of parcels 10,000 square meters (m^2) and larger shall be shown in hectares (ha).

3. The only unit of distance that will be used on survey plans will be the meter (m) and decimals of a meter. Centimeters and millimeters will not be used.

PROBLEMS TO PACKAGING INDUSTRY

The change to metric involves an adjustment to many product sizes to give sensible metric sizes. This presents an opportunity to coordinate the dimensions of many standards packages and to possibly reduce the number of sizes at present on the market. Rationalization of the range of product sizes should be of real benefit to the customers.

Europe standard and custom-made pack sizes have been arrived at 25, 50, 75, 100 thereafter multiples of 100.

All weighing machines will have to be changed.

CONSUMER EDUCATION

Many items people buy have nothing to do with weight nor any other measure. When dimensions are a factor, labels must be clear and detailed to conform with consumer protection guidelines.

STATUTORY NEEDS

The sales of consumer products is covered by Weights and Measures Laws. They will have to be changed.

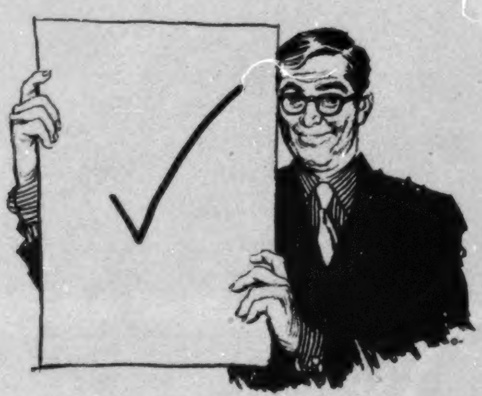
QUANTITIES

They will have to be put on the label. Metric unit base is 10. Quantities must be clear on labels.

MARKETING AND SALES CHECK LIST FOR METRIC-SI SYSTEM

1. Institute a market research program.
2. Consider what products can be eliminated before metric system takes effect in order to reduce capital outlay for changeover.
3. Usually companies can cut stock to customer by 30% without a fall off in standard of services to customers. Don't do this during the metric transition period and it could help warehousing problems.
4. Use a liasion with customers.
5. Assist in engineering studies.
6. Prepare a sales forecast during transition period. This will help one to analyze marketing problems.
7. Work closely with suppliers of materials.
8. Introduce modern statistical forecasting techniques. This will help in the master plan for total metric changeover.
9. Investigate and review methods of packaging, including any necessary changes to weights and measures.
10. Prepare new or modified sales literature and plan an appropriate sales program.
11. Train all marketing people in Metric-SI System.
12. Consider the interaction between metrication and decimalization and current pricing policies.

After a company has completed steps in this process, they should be reviewed for possible changes.



COMPANY TRAINING PROGRAM FOR METRICATION

WHEN TO GO METRIC

This will depend on supplies, trade associations, government legislation, and customer demands.

WHO SHOULD BE TRAINED

Levels of jobs: general, supervisory, management
Types of jobs: sales, etc.
Departmental requirements: packaging, purchasing, distribution, etc.

WHAT SHOULD BE TAUGHT

What new things people need to know and what is desirable to their job.
Content of training programs
Knowledge of metric measurement
Ability to work with decimals
Ability to convert (where necessary)
No one individual is ever likely to need the sum total of metric information and practice.

WHEN TO TRAIN

This will depend on target dates of the company.

TRAINING PROGRAMS

Short appreciation courses are the best. Whether they are held at Joint Vocational Schools, Technical Schools, or tailored for the company by consultants. Contact your high school distributive education coordinator for assistance.

Let's All Pull Together.

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FILM SUMMARIES

Resume of Film: WHY METRIC
Producer: Beloit Tool Corporation
Type: 16 mm sound/color
Time: 14 minutes

In 1793, the French developed a new unit of meaurement called metre. There was no need for the average person to learn. Nevertheless, it became the international standard of measurement. It is easily learned.

What is meters? Is it a new language?

Most people are only familiar with 3 units of measurement in their daily lives.

Meter is approximately 39 inches, 25 miles is 80 kilometers, and 44 pounds is 20 kilograms, 1 kilogram is equal to 2.2 pounds, litre is about 5% larger than a quart.

Metric is based on units of 10.

Larger than meter:

kilo = 1,000 meter
hecto = 100 meter
deca 10 meter

Smaller than meter:

deci = .1 meter
centi = .01 meter
milli = .001 meter

Unit of meter, square meter, cubic meter:

1 cubic decimeter
1 litre
1 dekameter
1 cubic centimeter
1 millilitre
1 gram

Decrease and increase by 10, 100, 1,000
To multiply, move decimal to left
To divide, move decimal to right

Abbreviations

m = meter
l = litre
g = gram
da = decka
h = heckto

k = kilogram
d = decimeter
c = centimeter
m = millimeter

km = kilometer
dm = decimeter
cm = centimeter
mm = millimeter

Resume of film: THINK METRIC
Producer: Coronet Films, Coronet Bldg, Chicago, Ill.,60601
Type: 16 mm sound/black and white
Time: 20 minutes

The purpose of this film is to popularize the metric system by explanation of the metric system and by showing how metric measurements may be incorporated into our thinking and everyday living.

Films of "metric games" are shown, with the 1 kilometer (1,000 meter) walk (2 1/2 times the length of a football field). Weigh-ins are held with one contestant registering 44 kilometers.

Metric measurements for temperatures are explained:

> In place of the Fahrenheit thermometer, the Celsius thermometer is used. On this thermometer, 0 is freezing and 100° is boiling point. This is much easier to remember than 32° freezing point, and 212° boiling point. Average room temperature in the metric Celsius is 20° - 25°
>
> In measurement of length, 1 meter = 100 centimeters = 1,000 millimeters.
>
> In measuring capacity, a 10 centimeter cube contains 1,000 cubic centimeters (10 x 10 x 10 = 1,000). 1 kilogram of water = 200 nickels in mass (1 nickel = 5 grams in mass).

Attention goes back to the "metric games", with an attempt to popularize again various metric measurements.

EX: Most men are between 1 and 2 meters tall (140 centimeters).

EX: The 100 meter dash is close to 100 yards, or the approximate length of a football field.

The film closes with a summary, which reminds all that the standard in the metric system for length is the meter, for volume is the liter, for weight the gram, and for temperature, the Celsius thermometer.

SUMMARY OF VIDEO-TAPE ON METRIC SYSTEM

by Society of Manufacturing Engineers for
The General Motors Institute

History of the Use of Measuring Systems

1. The U.S. has traditionally used the inch-foot-yard system.

2. In 1950, a uniform metric system to replace the various metric systems then in use was created. It was called the International System of Units. (SI)

3. With the British conversion to the metric system in 1965, all countries in the world, with the exception of some underdeveloped countries and the U.S., use the metric system as the primary measurement code.

4. In 1968, the National Bureau of Standards conducted a study on the impact of the wide usages of the metric system upon the U.S.

5. In 1971, the Bureau recommended that the U.S. should change its basic system of measurement to the metric.

    a) a careful and deliberate change was recommended.
    b) the change should be accomplished by a coordinated national program.
    c) detailed plans and timetables should be made up.
    d) early priority should be given to educating children and the public to metric thinking.
    e) the goal: within ten years, the U.S. should be using primarily, but not exclusively, the metric system.

Essentials of the Metric System (SI)

VARIOUS MEASUREMENTS	BASIC METRIC UNIT
length	meter
time	second
mass	gram
electric current	ampere
luminous intensity	candela
volume	liter
force	newton
temperature	kelvin

Origin of Metric Length

While a "yard" was originally intended to represent the length of a mature man's arm, the "meter" was derived from more exact sources: the distance from the North Pole to the Equator was divided into 10 million parts, each of which is exactly a meter in length.

Metric and U.S. System Equivalents

Comparative tables and terminology of the two systems is treated in detail in a number of pamphlets, folders, and brochures. A brochure is available at the U.S. Printing Office at cost.

Problems in Conversion to the Metric System in the U.S.

1. Public Apprehension

   a. We have been "brainwashed" by the old system, and feel very apprehensive about undertaking the changeover.
   b. This is only natural:
      (1) it is comparable to learning a foreign language.
      (2) or comparable to changing the keyboard of a typewriter, which has been recommended, but not yet implemented.

2. Difficulty of "thinking metric"

   a. Again, the analogy of the foreign language may be used, one who "thinks" English while speaking or listening to a foreign language has not mastered the language. Mastery lies in the ability to think in the language rather than employing mental translation. Until we have learned, for example, to think kilometers rather than thinking miles and translating to kilometers, we will not have mastered the metric system.

3. Wholesale conversion may be too drastic, but extended conversion will be too cumbersome.

Plans for Management Conversion to the Metric System

1. technical and professional people must learn the metric system.

2. they must learn to apply it.

3. the metric system must be recommended to management.

4. management must decide what kind of adoption to make (whole, partial, none).

5. management must develop and implement expansion of metric system usage.

6. technical and professional organizations must help the manufacturers.

7. a dual system (using both systems interchangeably) may be best at first, with later plans for complete conversion.

PROMOTIONAL MATERIAL

A Plan to Promote Metric Programs
in Distributive Education to Businesses

Business' top management must move immediately, not only to learn the fundamentals of the metric system, but also to establish a metric advisory group which can prepare a corporate plan of action.

There is no specific formula for going metric, each firm will have different circumstances. However, a competent man should be put in charge of planning. He should be thoroughly familiar with business practice, policy, and organization and must have full confidence and backing of top management.

A suggested check list for the metric advisory group in each business might cover the following:

1) The "Advisory Group" should start now to build a metric library.

2) Study metric background, history, and International Metric Standards - check government policy.

3) Investigate metrication in your own - and related businesses - as well as customers and competitors.

4) Prepare a general plan. Then prepare a detailed plan and schedule for each department and area affected.

5) Inform all personnel of your metrication policy and keep them posted on your progress.

6) Compile training and educational requirements for each category of employee and tie their education to the corporate schedule.

7) Establish company metric standards - making full use of ANSI (American National Standards Institute) as well as International Standards and the Metric Association.

8) Determine availability of metric material, merchandise, equipment, etc, and give your suppliers advance warning of your change.

9) Plan design of all new products in metric modules.

10) Make a list of all equipment which eventually will be affected when you wish to start producing Metric materials. Then decide which equipment will require conversion and which replacement.

11) Plan the use of dual equipment during the changeover and purchase new equipment capable of working in both customary and metric units.

12) Analyze new markets open to metric products, keep customers informed of your plans and your ability to furnish customary or metric materials.

13) Summarize your corporate plans by tying in all programs and time schedules by weaving them together to accomplish the least confusion and costs.

14) Consider "PERT" (Program Evaluation and Review Technique) to accomplish your goals.

Keep firmly in mind that a major change of this type may occur once in a thousand years. Failure to prepare your organization may well have serious effects as American business searches for manufacturers or suppliers who are familiar with the metric system and offer metric materials.

Businesses that carefully plan an aggressive approach to metrication and take advantage of this opportunity to critically analyze their merchandise and inventories will definitely profit during this period.

TIME FOR A
CHANGE

Congress plans National Metrics Board

U.S. going metric . . . but don't panic

By ANN McFEATTERS
Scripps-Howard Staff Writer

WASHINGTON — Advice to consumers worried about learning grams, liters and kilometers and forgetting pounds, quarts and miles as the nation moves to the metric system: Don't panic.

"You won't be buying your meat in kilograms and your milk in liters tomorrow," says Louis E. Barbrow. National Bureau of Standards coordinator for metrication — going metric. "For a while the effect will be trivial."

CONGRESS is about to create a National Metrics Board which will spend a year devising ways to switch the United States to the metric system, subject to final approval of the President and Congress.

One of its primary aims will be figuring how best to educate a confused and unwilling public to the change.

The nation has been going metric for several years and is preparing to take the final steps over the next 10 years because it is the only major country still measuring in inches, pounds and miles.

U.S. industry is having trouble selling machinery and parts to the rest of the world which measures in millimeters, grams and kilometers. This difficulty is costing U.S. industry billions of dollars.

EVENTUALLY, it will be 21 degrees Celsius (formerly centigrade) instead of 70 degrees fahrenheit, 38 liters instead of 10 gallons, 1.36 kilograms of potatoes instead of three pounds, 250 milliliters of milk for a recipe requiring a cup, and a man's shirt collar will be 41 centimeters instead of 16 inches.

But most Americans will not notice any real change for another five years or so.

A recent survey found most Americans don't understand metric measurement and don't want to. But the more they understand it, the more they like it.

MAJOR U.S. companies have begun converting to the metric system and many smaller firms, which have been worried about the cost, have become reconciled to it.

The first major step toward metrication most Americans will notice will be when schools begin teaching metrics as the primary method of measurement. So far only Maryland and California are planning to, but once Congress acts, the others are expected to follow quickly.

Teaching metrics is quicker than teaching the conventional U.S. system of inches, feet, yards, bushels and pecks. "It's like learning a foreign language," says Barbrow, "but there are only about 10 words. If children use it all the time, it will be easy for them."

THE METRIC system is based on multiples of 10. The basic unit of linear measure is a meter (39.37 inches). So a centimeter (.39 of an inch) is one one-hundredth of a meter while a kilometer (.62 of a mile) is 1,000 meters.

Here are some approximate equivalents of metric measurements and their abbreviations:

	LINEAR MEASUREMENTS	
Millimeter	(MM)	.03937 Inch
Centimeter	(CM)	.3937 Inch
Decimeter	(DM)	3.937 Inches
Meter	(M)	39.37 Inches
Hectometer	(HM)	109.36 Yards
Kilometer	(KM)	.621 Miles.
	AREA MEASUREMENTS	
Square Centimeter	(SQ CM)	.155 Square Inch
Square Meter	(SQ M)	10.764 Square Feet 1.196 Square Yards
Square Kilometer	(SQ KM)	.386 Square Mile 247.105 Acres
Hectare	(HA)	2.471 Acres
	WEIGHT MEASUREMENTS	
Gram	(G)	.035 Ounce
Kilogram	(KG)	2.205 Pounds
Metric Ton	(T)	2,204.623 Pounds
	LIQUID VOLUME MEASUREMENTS	
Liter	(L)	1.057 Quarts
Centiliter	(CL)	.338 Fluid Ounces
Deciliter	(DL)	.21 Pint

It's simple to convert kilometers to meters or to centimeters or millimeters (.04 of an inch), easier than having to deal in inches, feet and miles which have no direct mathematical relationship — just tradition.

But what is likely to drive Americans to distraction will be converting back and forth from metric measurements to standard American ones. Each conversion requires paper-and-pencil arithmetic.

THE CENTER for Metric Education at Western Michigan University has been spending federal money for several years to find ways to teach the public about metrics.

But most of its work so far has been directed toward teaching teachers and children. The center assumes some adults never will switch to metrics.

SAMPLE NEWS RELEASE OR BULLETIN BOARD NOTICE

SUMMER COURSES FOR ADULTS

"Think Metric" will be the featured course in our summer program. The course will teach the basics of metric weights and measurements with an emphasis on learning the metric system so well that the student will begin to think in metric measurements rather than continually converting to metric measurements. The course will cover:

METRIC DISTANCES:	meter, centimeter, millimeter, decimeter, dekameter, kilometer, myriameter, and other common designations.
METRIC WEIGHTS:	gram, centigram, milligram, kilogram, and others.
METRIC VOLUMES:	cubic millimeter, cubic centimeter, liter and others.
METRIC HEAT:	Celsius thermometer (centigrade), 0 freezing water, 100 boiling water, and others.
METRIC FORCE:	the newton and others.
METRIC TIME:	the second (no change)

The United States is the only major country which has not formally adopted the metric system. Our policy has been to work into our own system gradually increased use of the metric system, until conversion is complete. No time limit has been set. With the worlds of science and engineering already converted, it should not be long until use is so widespread that one will have difficulty functioning in world society unless he is familiar enough with metrics to "think metric." Hence, we offer this course to adults in the ________ area. High school credit may be earned. Times for the course will be arranged.

THOUGHTS FOR THE MONTH

Since 92% of the countries in the world use this system and the U.S. is in the process of adopting it, we offer this month these bits of information about the metric system:

A man 6 feet tall is 182 centimeters

A woman 5 feet 3 inches tall is 160 centimeters tall

A woman 38-24-36 is 97 cm - 61 cm - 91 cm

A 24 inch T.V. screen is 61 cm

30 miles per hour is 48 kilometers per hour

A 10 yard run is a 9 meter run in football

A 35 yard pass is a 32 meter pass

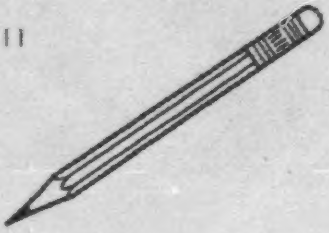
A 425' homer is a 130 meter homer

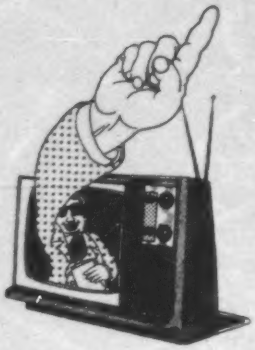
The mile runner travels 1,609 meters

An 8 inch pencil is 20 centimeters

8 1/2 by 11 inch sheet of paper is 22 cm by 28 cm

For golfers, a 15 foot putt is 4.6 meters





Metric System to Alter Picnic Weather

By DANIEL J. FOLEY
Copley News Service

WASHINGTON — The weatherman predicts 25-degree temperatures.

Today you'd probably bundle up when that's the forecast. Several years from now, you may plan a picnic.

BETWEEN NOW and then, the United States will have converted to the metric system, and the weatherman will be talking about Celsius degrees (formerly called centigrade) rather than Fahrenheit degrees. The 25-degree Celsius temperature will be equivalent to 77 degrees Fahrenheit.

That's only one of the ways in which more than 210 million Americans will have to adjust their thinking if the United States goes metric, as now seems inevitable. The United States is the only industrial country which has not switched.

Congress is now working out the details on legislation putting the country on a 10-year program of converting to the metric system.

WHILE SOME fear the confusion the switchover might bring, a large number of familiar products already are sold in metric units: photographic equipment, prescription drugs, foreign automobiles, cigarettes, skis and swimming pools, to name a few.

Scientists, soldiers and spacemen are among those who deal almost exclusively with metric weights and measures.

The metric system is of much more recent vintage than the customary system now in use in this country, a system which traces its origins to Babylonian, Egyptian, Roman, Anglo-Saxon and Norman French cultures.

THE METRIC system was born in the intellectual ferment of the French Revolution in the late 1700s, and in the last two centuries it has spread to most of the rest of the world.

The system uses six base units of measurement. Two are the same as already used in this country, time (measured in seconds) and nous intensity (measured in amperes). A third, luminous intensity (measureed in candela) is of little interest to the average person.

Most persons, therefore, will have to learn only three base units — for length (meters), mass or weight (grams) and temperature (Kelvin or Celsius degrees) — and some measurements derived from base units such as volume (liters).

THE MOST difficult problem for most adults will be to "think metric." Here are some handy rules to help:

- The unit for length, the meter, is slightly longer than a yard (about 1.1 yards.
- The unit for volume, the liter, is slightly larger than a quart (about 1.06 quarts).
- The unit for mass, the gram, is about the weight of a paper clip.

SINCE THAT is so small, it may be more convenient to remember that the kilogram is a little more than 2 pounds (about 2.2 pounds).

MULTIPLES AND PREFIXES

Multiples and Submultiples	Prefixes
1,000,000	mega
1,000	kilo
100	hecto
10	deka
Base unit 1	
0.1	deci
0.01	centi
0.001	milli
0.000001	micro

In addition to learning the base units, each person will have to memorize the prefixes which indicate weights and measures smaller and larger than the base units.

The metric system is a decimal-based one, like the U.S. monetary system of dollars and cents. Larger and smaller measurements are derived by multiplying and dividing the base unit by 10 and its multiples.

THE PREFIX kilo means 1,000 times the base unit. Thus, a kilogram is 1,000 grams. The prefix milli means one-thousandth of the base unit. Thus, millimeter is one-thousandth of a meter.

(The most commonly used prefixes are shown on the accompanying chart.)

Some schools, those in California among them, already have begun to emphasize the teaching of the metric system. Educators say the children learn it more easily than the customary system because of the decimal feature and its standardized nature. For those who grow up "thinking metric," there will be few problems.

FOR THOSE who must adjust, there will be some problems. That's the reason for the 10-year period for conversion.

Workers will have to be retrained and old machinery, as it wears out, will have to be replaced with new equipment geared to the metric system. For a while, dual inventories will have to be maintained — some parts for customary equipment and some for metric.

Customary units will not be dropped entirely, however. The "rule of reason" will apply. No one wants to tear up thousands of miles of railroad track just to relate trackage to some round-number metric gauge.

FOOTBALL fields will continue to be measured in yards and, for a few years at least, those old sayings ("give 'em an inch and they take a mile") will still be around.

For most, learning the new system will be through everyday encounters, listening to the weather report, buying milk by the liter and hamburger by the kilogram and reading highway signs posted in kilometers.

METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
In.	inches	2.5	centimeters	cm.
Ft.	feet	30	centimeters	cm.
Yd.	yards	0.9	meters	m.
Mi.	miles	1.6	kilometers	km.
		AREA		
	acres	0.4	hectares	ha.
		MASS (weight)		
Oz.	ounces	28	grams	g.
Lb.	pounds	0.45	kilograms	kg.
	short tons	0.9	tonnes	t.
		VOLUME		
Tbsp.	tablespoons	15	milliliters	ml.
Qt.	quarts	0.95	liters	l.
Gal.	gallons	3.8	liters	l.

Approximate Conversion from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
Cm.	centimeters	0.4	inches	in.
M.	meters	3.3	feet	ft.
M.	meters	1.1	yards	yd.
Km.	kilometers	0.6	miles	mi.
		AREA		
Ha.	hectares	2.5	acres	
		MASS (weight)		
G.	grams	0.035	ounces	oz.
Kg.	kilograms	2.2	pounds	lb.
T.	tonnes	1.1	short tons	
		VOLUME		
L.	liters	1.06	quarts	qt.
L.	liters	0.26	gallons	gal.

Sunday, March 10, 1974
The Columbus Dispatch

Metric 'Wheels' Already Turning

By BETTY DAFT
Of The Dispatch Staff

Congress may be dragging its feet on the conversion to the metric system but Columbus area schools are way ahead — by a country kilometer.

Some school districts have already added instruction on metrics and officials of other school systems are planning to add study units next year.

AND AT EASTLAND Vocational School, the metric system has always been taught in courses like engineering drawing and mechanics because students work on foreign cars built to metric measurements.

A bill to make the metric system the official standard of the country, allowing for a 10-year changeover period, was passed by the U.S. Senate in August, 1972, but it has been held up ever since by the House of Representatives.

Observers, however, expect it to emerge soon from the House Rules Committee, and Columbus area schools are preparing to introduce the change first through supplementary materials, and finally with textbooks written entirely with metric tables.

ROBERT McNEMAR, director of Columbus Schools' department of science and math, pointed out that metrics, "with its base 10 and all units related" is the same decimal system used in money and counting systems, and is easy to learn.

"It would also eliminate most fractions, although we would still refer to a half-cake or a quarter-pie," McNemar said.

Columbus schools' math books for grades three through six have units on the metric system this year and there has been some experimental use of a metric workbook.

THE SCHOOL system has mostly concentrated on workshops for teachers so they will be prepared, McNemar said.

Elementary teachers in Upper Arlington Schools have been teaching the metric system this year along with the traditional system, and the newly equipped mathematics laboratory at Burbanks Elementary is stocked with the latest equipment in introducing metrics.

Dr. Emily Schuh, director of elementary education, emphasized that the district is teaching metrics as a second system.

CHILDREN ARE being taught the working units of the metric system — the unit for length is the meter, the unit for mass is the gram, and the unit for volume, the liter.

Both systems are also taught simultaneously this year in all grades in South-Western Schools, and math teachers in Columbus Catholic Diocese schools have put more emphasis on metrics.

THE SEVEN local school districts in the Franklin County School system are using "good, free material" supplied by the Ohio Department of Highways as supplemental material, Anna Freeman, director of education, said.

Officials of other school districts within the county say that planning has started and the curriculum will be adjusted when it becomes known what timelines are set for the transition to the metric official weights and measure standard.

THE SUN, Springfield, O. Thursday, Feb. 21, 1974 25

Educators Slow In Switching To Metric System

By CAROLE MARTIN

NEW YORK — (AP — Schools generally have been slow to introduce metric measurement despite research that indicates as much as a fourth of the time spent teaching arithmetic could be saved by using the metric decimal system.

Richard Cortright, the National Education Association's staff liaison for metrication, said school officials are probably just waiting for the federal legislation that will switch the whole country to metrics.

The United States is the only major country which has not adopted metrics as its system of measurement. Bills providing for a conversion to metrics have been stalled in Congress for years.

But, on their own, hundreds of elementary school teachers across the country are now emphasizing meters and grams in their classrooms along with inches and pounds.

Youngsters in places as diverse as Shawnee Mission, Kan., and Princeton, N.J., are being taught to measure their height in centimeters and to weigh cookies in grams and milk in liters.

Children have no built-in preference for the foot-pound system of measuring, according to Denise Grohs, who teaches science to elementary students at New York's Walden School.

Indeed, Miss Grohs' fourth grade class was quick to say metrics is easier.

"The system is easier," says Miss Grohs. "It's based on a clear-cut decimal system. A meter equals 10 decimeters or 100 centimeters. One decimal equals .1 meter. For calculations, all one does is add zeros or move decimal points. There are no difficult fractions."

On the other hand, she says, many students have difficulty remembering how many feet—5,280 — or how many yards — 1,760 — are in a mile.

In the past year, a number of states have taken steps to make metrics the "first language" of measurement in their schools by the end of this decade.

Maryland was the first state to announce its intention to switch its schools over to the metric system of measurement over a six-year period beginning next fall.

California School Supt. Wilson Riles wants all science and math books approved for kindergarten through eighth grades to contain units on metrics by 1976. He also asked the legislature for funds to train teachers in metrics this year.

The British are saying if they had to make the transition again, they'd do more preparing in the schools. If the transition takes 10 years, the schools must be started first," Riles said. "I want education to keep abreast of the times for once. If we can catch youngsters now, that will be one whole generation we won't have to unlearn."

In Florida, the education department is developing materials to explain the change to metrics to parents as well as to students and teachers, and Florida universities have been directed to offer partial instruction in both metrics and the inch-pound system at all levels and in all disciplines.

Late in 1973, New Jersey's State Board of Education urged its school districts to initiate programs of instruction in metrics so it would be the primary language of measurement at all levels of instruction by 1976.

Minnesota has held workshops for math teachers in that state, and Bowling Green University in Ohio now teaches its education majors methods for presentation of the metric system.

In New York City, George Grossman, director of math education, said the school system was concentrating on teacher training and curriculum revision now so that metrics could be offered from third grade on. He said only new textbooks which contain units on metric measurements would be purchased in the future.

Publishing firms are beginning to add more extensive units on the metric system now. The average cycle for replacing textbooks is five years, so a district which purchased new texts in 1972 and replaced them routinely would be able to bring metrics textbooks into its schools in 1977 without extra cost.

Meanwhile, a conference on metric education sponsored by University of Southern Mississippi last week drew enough commercial exhibitors of new metric teaching aids to lead one cynic to comment: "If this many companies think there's a market for this stuff, maybe metric education is on its way."

Robert A. Canei
Springfield-Clark County
Joint Vocational School
Adult Department
1901 Selma Road
Springfield, Ohio
325-5461

SAMPLE NEWS RELEASE

July 14, 1974

ATT: Dave Masters

The Adult Department at the Springfield-Clark County Joint Vocational School is keeping up with the changes in the United States by offering its first series of metric workshops for individuals in the Springfield area.

Persons may attend these workshops who are in the following areas: teachers in all vocational areas, business and industry personnel that have to work with machines, blueprints, and any other type of occupations which deal with math.

This workshop will be set on a 25 hour schedule. It will begin August 6, 1974 and end August 22, 1974, Tuesday, Wednesday, and Thursday from 9:30 a.m. to 2:30 p.m. The cost will be $10.00 and this includes all materials.

Course content will consist of working metric problems in length, volume, and weight. This program will not be conducted for conversion methods, but to actually teach individuals to work metric problems.

The instructor for this program will be Flo Keaton, who has had a number of years' experience in metrics in her teaching and business experiences.

All people in the Springfield area should look into this program because metrics will be here in the future.

For additional information and registration, contact: 325-5461

ADULT DEPARTMENT

SPRINGFIELD - CLARK COUNTY JVS

THE ADULT DEPARTMENT AT THE SPRINGFIELD - CLARK COUNTY JVS IS OFFERING CLASSES THIS SUMMER FROM 10:00 a.m. - 12:30 p.m.

ALONG WITH EXCELLENT FACILITIES WE ALSO MAINTAIN A STAFF OF HIGHLY QUALIFIED INSTRUCTORS.

"THINK METRIC" WILL BE THE FEATURED COURSES IN OUR SUMMER PROGRAM. THESE COURSES WILL TEACH THE BASIC OF METRIC WEIGHTS AND MEASUREMENTS WITH AN EMPHASIS ON LEARNING THE METRIC SYSTEM SO WELL THAT THE STUDENT WILL BEGIN TO THINK IN METRIC MEASUREMENTS RATHER THAN CONTINUALLY CONVERTING TO METRIC MEASUREMENTS.

FOR MORE INFORMATION, CONTACT:

Adult Department
Springfield-Clark County JVS
1901 Selma Road
Springfield, Ohio 45505

PHONE: 325-5461

THINK METRIC!

volume

length

weight

WHAT: Become acquainted with the Metric System that soon will be America's Standard of Measurement.

WHEN: Beginning: August 6, 1974
Ending: August 22, 1974

Tuesday, Wednesday, Thursday from 9:30 a.m. - 2:30 p.m.

WHERE: Adult Department, Springfield-Clark County Joint Vocational School
1901 Selma Road, Springfield, Ohio

COST: $10.00 - This includes all materials.

INSTRUCTOR: Ms. Flo Keaton, who is looking forward to helping people bridge the gap from one system to another.

FOR MORE INFORMATION, CALL: 325-5461

METRIC SYSTEM WORKSHOP SET*

A series of metric workshops for individuals in the Springfield area are being planned by the adult department of the Springfield-Clark County Joint Vocational School.

One is scheduled to start August 6 and will be held on Tuesday, Wednesday, and Thursday, from 9:30 a.m. to 2:30 p.m., through August 22, Robert A. Canei, coordinator said.

Persons should attend these workshops who are involved in areas that especially will be affected by the eventual change to the metric system in the future. These would include teachers in all vocational areas, business and industry personnel that have to work with machines and blueprints and any other types of occupations which deal with math.

"Course content will consist of working metric problems in length, volume, and weight." said Canei.

For additional information and registration, contact Mr. Canei at 325-5461.

LET'S GET TOGETHER!

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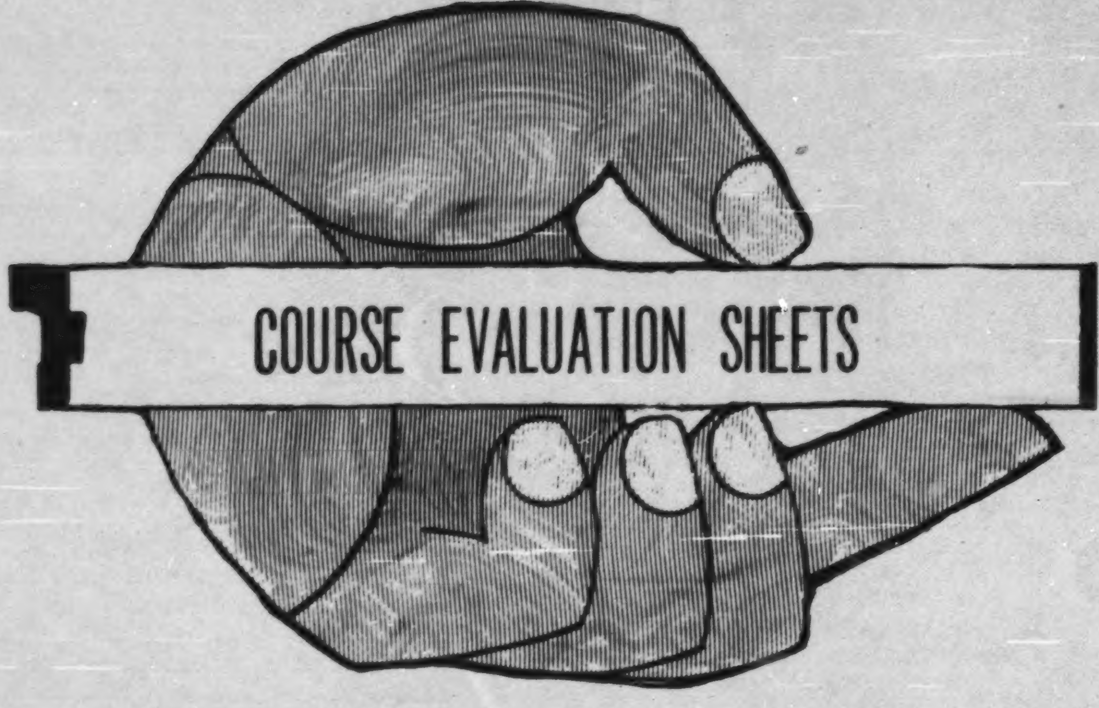
* Springfield News and Sun, July 18, 1974



COURSE EVALUATION SHEETS

PROFILE OF TEACHING PERFORMANCE

Date ____________________ Course ____________________

Where held ____________________ Topic ____________________

City ____________________ No. of Women ________ No. of Men ________

Time of Day: A.M. ______ P.M. ______ Instructor ____________________

Place a dot on each line at a place which will indicate the rating on this point. At the conclusion of the rating, make a profile by drawing a line connecting the dots.

	Low			Average			High
Rating of training performance:	1	2	3	4	5	6	7

TRAINING ABILITY

1. Suitability of content .... ____________________
2. Knowledge of subject .... ____________________
3. Organization of content .... ____________________
4. Appointment of time .... ____________________
5. Introduction .... ____________________
6. Appropriateness of methods .... ____________________
7. Handling of visual aids .... ____________________
8. Group participation .... ____________________
9. Handling of discussion .... ____________________
10. Closing .... ____________________

PHYSICAL DETAILS

1. Light, heat ventilation .... ____________________
2. Room arrangement .... ____________________
3. Room equipment .... ____________________
4. Teaching supplies .... ____________________
5. Attendance and record keeping .... ____________________

PERSONAL QUALITIES

1. Appearance - dress .... ____________________
2. Quality of voice .... ____________________
3. English - manner of speaking .... ____________________
4. Poise - bearing - movement .... ____________________
5. Group management and control .... ____________________

On reverse side on sheet, give concrete examples to justify items receiving a noticeably high or low rating. Also explain any extenuating circumstances which may have affected the teaching situation.

STUDENT COURSE EVALUATION SHEET

Your cooperation and assistance in the evaluation of the course you have just completed, when compiled with the evaluations of the other members of your group will aid us in the improvement of future courses and programs. Please answer all questions. Use reverse side for additional comments.

COURSE ______________________ INSTRUCTOR ______________________

1. Was the length of the course: too short ___; too long ___; about right ___.

2. Was the class scheduled at a convenient time for you? Yes ___ No ___. If not, when would be a convenient time for you? ______________________

3. Please rate this course as follows: (E-Excellent) (G-Good) (F-Fair) (P-Poor)

    (a) Course Topics of Study E _____ G _____ F _____ P _____
    (b) Arrangement of Topics of Study E _____ G _____ F _____ P _____
    (c) Method(s) of Teaching E _____ G _____ F _____ P _____
    (d) Visual Aids E _____ G _____ F _____ P _____
    (e) Materials Used in Class E _____ G _____ F _____ P _____
    (f) Qualifications of Instructor E _____ G _____ F _____ P _____
    (g) Counseling Services Provided E _____ G _____ F _____ P _____

4. Do you believe this course (basically the same) should be offered again? Yes ___ No ___

5. What improvements, if any would you suggest? ______________________

    ____

6. Have you been able to use, or do you anticipate using in your business, the information received in this course? Yes ___ No ___

7. As a result of taking this course, do you expect: A promotion ___ A new job ___ A salary increase ___ To better qualify yourself for present job ___.

8. What future courses would you like to take?

    1. ______________________ 2. ______________________
    3. ______________________ 4. ______________________

9. What new courses would you like to see offered in the Adult Education Program?

    1. ______________________ 2. ______________________
    3. ______________________ 4. ______________________

10. Additional comments you would like to make: ______________________

    ____

Date:

____
Signature (Optional)

OBSERVER'S CHECKLIST

Place a check (✓) at the performance level which you think is appropriate for each item.

CRITERION	PERFORMANCE LEVEL				
	Low		Median		High
	1	2	3	4	5
INTRODUCTION					
1. The subject matter; the instructor					
a. indicated what it was about	___	___	___	___	___
b. stated why it was important	___	___	___	___	___
2. A motivational technique:					
a. was used	___	___	___	___	___
b. drew student attention	___	___	___	___	___
c. was interesting	___	___	___	___	___
3. A purpose:					
a. was stated by the instructor	___	___	___	___	___
b. was stated in behavioral terms	___	___	___	___	___
c. was clear to the student	___	___	___	___	___
d. was within student ability level	___	___	___	___	___
PRESENTATION					
1. Verbal behavior:					
a. is clear	___	___	___	___	___
b. can be heard	___	___	___	___	___
2. Nonverbal behavior:					
a. is used	___	___	___	___	___
b. is appropriate	___	___	___	___	___
3. Content is ordered, logical	___	___	___	___	___
4. An audio or visual device is used	___	___	___	___	___
5. Student response:					
a. all had a chance to respond	___	___	___	___	___
b. appeared alert and attentive	___	___	___	___	___
6. Student participation is varied	___	___	___	___	___
7. Reinforcement was used appropriately	___	___	___	___	___
SUMMARY					
1. A summary was used	___	___	___	___	___
2. Key points were enumerated	___	___	___	___	___
3. A transition was used	___	___	___	___	___

* *

	Low		Median		High
	1	2	3	4	5
Teacher knew subject matter	___	___	___	___	___
Teacher showed evidence of planning	___	___	___	___	___
Personal appearance of teacher was appropriate	___	___	___	___	___
Teacher was enthusiastic	___	___	___	___	___
TOTAL RATING	___	___	___	___	___
OVERALL SCORE	___	___	___	___	___

Instructor ________________________________ Date ________________

Observer ________________________________

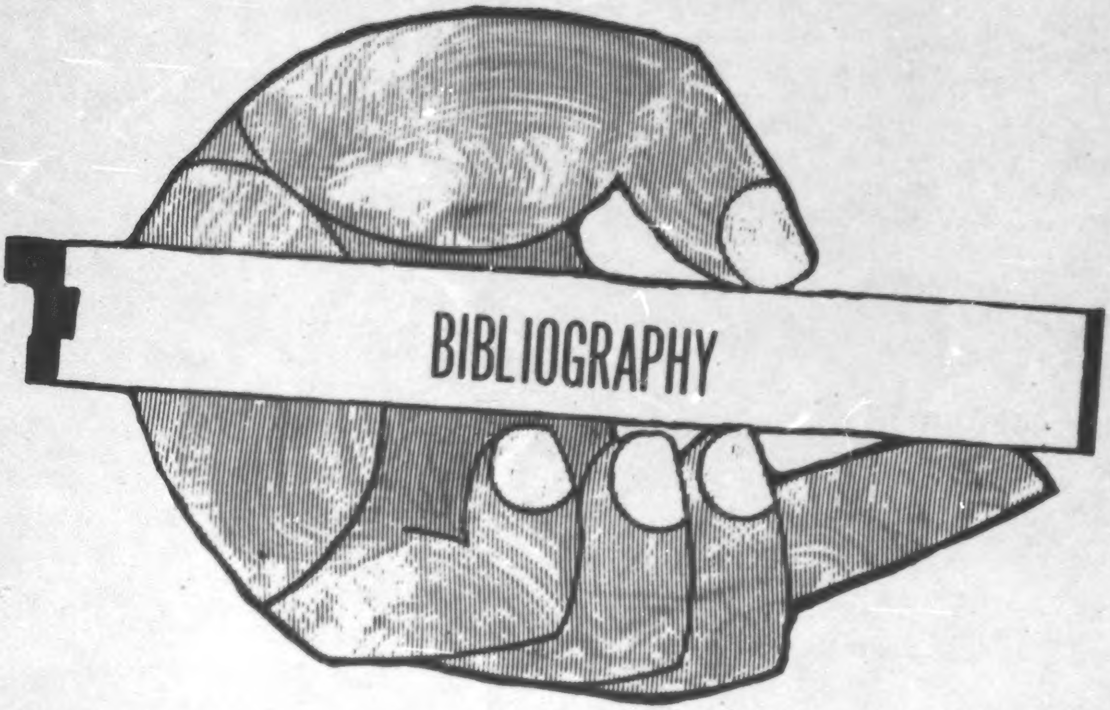
Comments: ____

____

____

____

____


BIBLIOGRAPHY

Information about the Metric System can be obtained from the following companies:

Allyn and Bacon, Inc.
Publishers
Boston, Massachusetts

American Management Association
135 West 50th Street
New York, New York 10020

American National Standards Institute, Inc.
1430 Broadway
New York, New York 10018

Center for Metric Education
Western Michigan University
Kalamazoo, Michigan 49001

Central Instrument Co.
900 Riverside Drive
New York, N.Y. 10032

Coronet Films
Coronet Instructional Materials
369 Erie Street
Chicago, Illinois 60610

Construction Product Services, Inc.
Goldstar
3 Parkway Center Suite 111
Pittsburgh, Pennsylvania 15220

Delmar Publishers
Albany, New York 12205

J.J. Keller & Associates, Inc.
145 W. Wisconsin Ave.
Neenah, Wisconsin 54956

Laidlow Brothers, Publishers
Division of Doubleday and Co., Inc.
River Forest, Illinois

Library Filmstrip Center
3033 Aloma
Wichita, Kansas 67211

National Bureau of Standards
Washington, D.C. 20234

National Tool, Die and Precision
Machining Association
9300 Livingston Road
Washington, D.C. 20022

Ohio Department of Transportation
State of Ohio
Columbus, Ohio 43215

J.C. Penney Co. "Moving Toward Metric"
1301 Avenue of the Americas
New York, New York 10019

Regal-Beloit Corp.
Rockton Road P.O. Box 38
South Beloit, Illinois 61080

Singer Society for Visual Education, Inc.
Educational Division
1345 Diversey Parkway
Chicago, Illinois 60614

Small Business Administration
Washington, D.C. 20416

Superintendent of Documents
U.S. Government Printing Office
Washington, D.C. 20402

Swani Publishing Co.
Box 248
Roscoe, Illinois 61073

The Center for Vocational and Technical Education
The Ohio State University
1960 Kenny Road
Columbus, Ohio 43210

Weybright and Talley
750 Third Avenue
New York, New York 10017

Metric Association, Inc.
Sugarloaf Star Route
Boulder, Colorado 80302

U.S. Department of Commerce
National Bureau of Standards
Washington, D.C. 20402

Robert C. Sellers and Associates
Floral Park, New York 11002

National Association of Purchasing
Management, Inc.
11 Park Place
New York, New York 10017